



Institute for Glycomics
ANNUAL REPORT 2023



Our mission

Fighting diseases of global impact through discovery and translational science.



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Our vision

To be a world-leader in the discovery and development of drugs, vaccines and diagnostics through the application of innovative multidisciplinary science in a unique research environment.

INSTITUTE HIGHLIGHTS



3 MAJOR RESEARCH THEMES

- Cancer research program
- Infectious diseases research program
- Neurological disorders research program



OVER 200 INSTITUTE MEMBERS

- Research scientists
- Research students
- Professional staff
- Visiting scientists and adjunct appointments



COMMUNITY ENGAGEMENT

- **Community Bank Paradise Point** supporting our Grand Ball, Summer Student Scholarship Scheme and Flow Cytometry Facility
- **Warren and Sally von Bibra** supporting our honours and masters student scholarship scheme
- **Sanctuary Cove Golf and Country Club** joining forces with our Institute to fight breast cancer
- **Maureen Stevenson** supporting research through PhD Scholarship and Glycomics Circle
- **Glycomics Circle** empowering women in science
- **Women in Racing** supporting our glycomics research
- **Rotary District 9640** a powerful partnership to end malaria
- **Earbus Foundation** Harvey Coates research scholarship for middle ear infection vaccine development.



INCOME SOURCES FOR 2023

- Research grant funding – \$7,083,316
- Industry, philanthropic & other support – \$9,586,705



4 PATENTS

Filed on new Institute technologies



CLINICAL TRIALS

- **Phase Ia clinical trial** underway in Canada – Institute vaccine for the prevention of **Group A Streptococcal infection**
- Preparing to enter a **Phase Ib clinical trial** with challenge in Australia – Institute vaccine for the prevention of **Group A Streptococcal infection**
- **Phase II clinical trial** nearing completion – repurposed vaccine for prevention of **gonorrhoea**
- **Phase Ib clinical trial** completed in Australia and **Phase II** commenced in China by Grand Medical – Institute drug for treatment of **sepsis**



470+ PUBLICATIONS

(over 5 years)



PARTNERING

Engagement with over 68 industry partners for basic research, translation and commercialisation



15,160 CITATIONS

(over 10 years)



\$1 for \$1

Every donation is a valued contribution and 100% of the gift goes to the area of choice.

2023 PHILANTHROPIC ENGAGEMENT

- **Bourne Foundation** – supporting prostate and ovarian cancer research and NMR Facility
- **Order of St John of Jerusalem Knight Hospitaller the Commandery of SEQ Inc** – supporting our world class research
- **Southern Paradise Foundation Pty Ltd** – supporting students in biomedical research
- **The Snow Foundation** – supporting the development of our streptococcus A vaccine
- **The Hay Family Benevolent Fund** – supporting melanoma research
- **Leducq Foundation** – supporting the development of our streptococcus A and rheumatic heart disease vaccine
- **Voudouris Group** – supporting lung and colon cancer research
- **Raymond James** – supporting the establishment of the Raymond James Chair of Translational Biomedicine



About us

The Institute's research is focused on the identification of new preventions, cures and diagnostic methods for infectious diseases, cancer and neurological disorders. The Institute places a strong emphasis on translational research and commercialisation, to have a meaningful impact on human health globally.

Established in 2000, through investment by Griffith University and the Queensland Government, the Institute for Glycomics is one of Australia's flagship interdisciplinary translational biomedical research institutes, based in the heart of Griffith University's Gold Coast campus and the Gold Coast Health and Knowledge Precinct.

The Institute boasts state-of-the-art facilities combined with some of the world's most outstanding researchers focused on biomedical research and 'glycomics', a constantly expanding field that explores the structural and functional properties of carbohydrates (or sugars) and their roles in disease.

We engage in global research partnerships, in projects that cut across multiple disciplines to apply new approaches to the identification, treatment and prevention of diseases.

Comprising over 200 staff and students, we strive to be world leaders in the discovery and development of next generation drugs, vaccines and diagnostics for diseases of global impact.

The Institute's rich and enabling research environment provides exceptional Honours, Masters and PhD education programs for the nation's future scientists. Research students are given the opportunity to study alongside some of the world's most experienced and well-known research leaders and scientists, with access to state-of-the-art research equipment and facilities.

The Institute engages with industry, other premier research institutes, philanthropic organisations and governments from across the globe, giving it significant research capacity to provide healthcare solutions to address some of the world's most intractable diseases.

With an outstanding track record in translating biomedical discoveries to the clinic, there is little doubt that our unique approach will play a major role in the discovery and development of next generation drugs, vaccines and diagnostics with the power to change our future.



What is Glycomics?

Scan the QR code for a video illustration.



Director's report

It is my great pleasure to report on the continued achievements and successes of the entire Institute for Glycomics family – the research faculty, students and support teams alike over the course of 2023.

It was certainly another tremendously successful year for the Institute. We welcomed many new staff and students and celebrated research successes, leadership promotions, outstanding achievements, PhD conferrals and high impact journal publications. We were also delighted to welcome many of our valued supporters to the Institute and host numerous important events.

There were so many exciting highlights in 2023, all of which are outlined more comprehensively in the pages that follow.

To spotlight just a few; the Institute for Glycomics officially opened three of our state-of-the-art facilities: the Gold Coast site of the recently established \$280 million Translational Science Hub which is an exciting collaboration with Sanofi, the Queensland State Government and University of Queensland, that links world-class researchers in Queensland with scientists at the Sanofi mRNA Centre of Excellence in France and the USA to develop the next generation of immunisations.

The Bourne Foundation Nuclear Magnetic Resonance (NMR) Facility, an institute core facility has been rebuilt to house the world's latest NMR instrumentation with significant investment from Bourne Foundation.

Another long-term supporter, Community Bank Paradise Point provided philanthropic support towards the purchase of a new flow cytometry instrument and joined us to officially open the Community Bank Paradise Point Flow Cytometry Facility.

We made exciting progress, reached important milestones and received crucial funding towards many projects within our cancer, infectious disease and neurological disorders research programs. Many of our Institute assets continue to progress through the clinical development pipeline.

We are delighted to report that we had 10 research students awarded their PhDs in 2023, an incredible achievement as they embark on their future careers and also a proud moment for their families and Institute supervisors.

We had remarkable grant successes in 2023, with Institute for Glycomics researchers awarded over \$7,083,316 in research grant funding and \$9,586,705 in industry, philanthropic and other support, which is all vital to the continuation of our vast range of research projects and clinical trials.

On a personal note, it was with a sense of fulfilment, deep reflection and immense pride, that I announced my term as founder and Director of the Institute for Glycomics would conclude at the end of 2023.

Over two decades ago I came to Griffith University with the single focus of establishing a world-leading national centre of translational research excellence on the Gold Coast. There are very few people in the world that are given such an honour and challenge to establish a unique research institute. With the long-standing support of the various Queensland State Governments, the City of Gold Coast and the unshakable commitment of Griffith University, I believe that we have been successful.

This vision could not have been realised without the invaluable support and commitment I received from the Institute's dedicated research, operation, business and administrative staff; the Institute's Executive Group, our Board of Advice and Scientific Advisory Board and many international colleagues. Our human fabric and physical infrastructure has created a research environment that is the envy of many national and international research centres.

I am deeply grateful for the support of the Gold Coast community and the many philanthropic donors I have engaged with over the years. Your support has been a critical ingredient in the Institute's success, and I know that your enthusiasm and generosity will continue into the future.

I am very humbled to have worked in the role of Director for so many years, with so many talented people. I leave my Directorship knowing that I have achieved much of my vision and the Institute's foundation is set for amazing things. I now look forward to the next chapter of this internationally-recognised Institute and to continue my research at Griffith University in the role of Distinguished Professor. This will include leadership of the Griffith-based Australian node of the Fraunhofer International Consortium of Anti-infectives Research (iCAIR), a significant joint initiative between Griffith University's Institute for Glycomics and the Fraunhofer Institute for Toxicology and Experimental Medicine in Hannover, Germany.

I am very pleased that the Institute's transition to the next chapter will be under the leadership of Professor Mike Jennings who accepted the role of Acting Executive Director supported by Professor Kate Seib as Acting Deputy Director of the Institute for Glycomics from 1 February 2024.

Fighting diseases of global impact is the most important vision of the Institute and I have no doubt this fight will go on.

Professor Mark von Itzstein AO

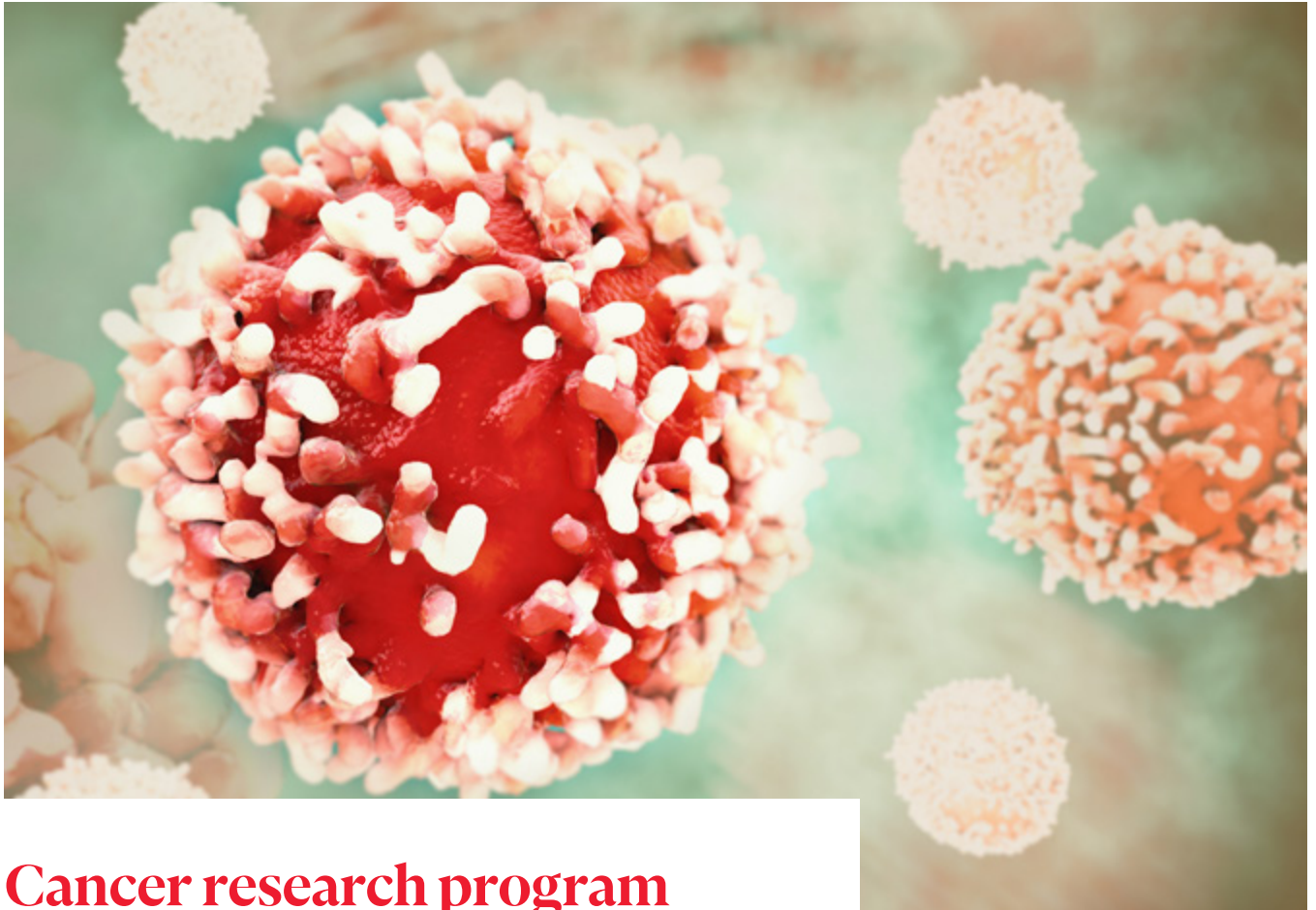
Foundation Director, Institute for Glycomics



REMARKABLE SCIENCE

Our world-renowned research leaders and their dedicated research teams work around the clock, seeking new opportunities that can lead to novel drugs, vaccines and diagnostics, translating our research into tangible benefits for the global community.

Our specialist research programs are centred around cancer, infectious diseases, and neurological disorders.



Cancer research program

Cancer is a leading cause of death worldwide, accounting for nearly 10 million deaths in 2020. Globally, about 1 in 6 deaths is due to cancer. Our cancer research specialists aim to reverse these alarming statistics through the discovery and development of new scientific technologies to fight disease.

All human cells are extensively decorated with a range of complex sugar moieties (glycans), which form the host cell glycome (the cell's sugar language). These glycans are utilised as receptors for a variety of proteins, and the inter-cellular interactions between glycans and proteins play an essential role in how cells communicate with each other and their environment. Not surprisingly, they also play critical roles in maintaining health and in the pathogenesis of disease, including cancers.

Surprisingly, the language of glycan interactions, the glycome, remains poorly understood, particularly when compared to our knowledge of the genome (the language of genes) and proteome (the language of proteins). The technology required to deep-sequence the human glycome using human clinical tissue has only recently been developed, and the Institute for Glycomics is a pioneer in this field.

Extensive investment into the understanding of the cancer genome and proteome has led to tremendous advances in cancer care. Despite this, biomarkers for many cancers remain unidentified following proteomic and genomic analyses, suggesting that there is a gap in critical knowledge.

An increasing body of literature indicates that the cancer glycome is of equal importance to understanding disease pathogenesis as the genome and proteome. The glycome represents an underexploited aspect of cancer research, and in combination with the cancer genome and proteome, holds the key to diagnosing, treating and preventing cancers.

Close collaboration between clinical and translational research scientists is the key to success for any patient-oriented research. The Australian Cancer Research Foundation International Centre for Cancer Glycomics (ACRF I2CG) is one of the Institute for Glycomics' Centres of Excellence. It is a unique hub of exciting and revolutionary cancer glycomics research, where world-renowned experts in both the fields of basic science and clinical research combine resources, utilising state-of-the-art advanced mass spectrometry equipment and advanced technologies to decipher the changes to the glyco-code that occur in cancer.

The goal of the ACRF I2CG is to identify the glyco-language in these states in serum, tissue biopsies and *in vivo* in a clinical scanner of patients at high risk for cancer as well as those with a malignancy.

The team of glycomics experts work with surgeons, radiologists, scientists, and high-risk cancer clinics to develop early markers in high-risk cohorts and therapeutics based on inhibition of the pertinent glycoconjugates.

In collaboration with other experts from around the globe, our researchers within the cancer research program made remarkable advances in 2023. Here are some of the highlights:

Enhancement of analytical capabilities

Utilising the analytical capabilities of the recently acquired Orbitrap Eclipse mass spectrometer and the Hyperion+ CyTOF imaging system, researchers have begun the detailed characterisation of glycopeptides and oncological immunological markers derived from a variety of archived histopathological tissues, including those from ovarian, melanoma, breast, Diffuse Intrinsic Pontine Glioma (DIPG), sarcoma and prostate cancers.

Meticulous optimisation processes have enabled the quantification of over seven thousand proteins from less than 200 nanograms of protein extracts obtained from biopsy tissue sections.

Currently research scientists are in the preparatory phase of sample analysis, aiming to co-localise glycan imaging with immune-oncological marker imaging within the same tissue sections. This dual-focus approach underscores the commitment to advancing the field of molecular biology by providing intricate details on the molecular landscape of cancer tissues, thereby opening new avenues for the identification of novel biomarkers and therapeutic targets.

Ovarian cancer

The Ovarian Cancer Research Foundation (OCRF) grant-funded project led by chief investigators Professor Michael Jennings, Professor Carolyn Mountford and Professor Daniel Kolarich has made significant progress. A clinical trial to obtain patient tissue and body fluids at different points of the cancer diagnosis pre- and post-treatment has been established and ethics approved, working closely with clinicians at Princess Alexandra Hospital in Brisbane.

Breast cancer

Research has produced an extensive dataset examining the effects of pre-operative oral carbohydrate intake on the proliferation of breast cancer and patient survival rates. Findings from recent clinical trials indicate that pre-operative hyperglycemic loading can lead to increased cancer cell proliferation and adversely affect outcomes in patients with estrogen receptor-positive breast cancer.

Sarcoma

A significant cohort of sarcoma samples has been established from both international and local sources including Fundación Pérez Sremini paediatric hospital in Montevideo, Chris O'Brien Lifehouse and the Tumour Bank at the Children's Hospital at Westmead. These partnerships have yielded samples across various high-grade sarcomas such as osteosarcoma, Ewing sarcoma, Rhabdomyosarcoma and chondroblastic osteosarcoma, all accompanied by detailed clinical histories.

Colorectal cancer

The issue of hematogenous metastasis presents a significant clinical challenge in colorectal cancer management. Research is focused on deciphering the functional importance of CD44 isoforms in this process. Initial analyses have identified specific CD44 isoforms present in colorectal cancer patients, which are believed to play a pivotal role in spontaneous metastasis.

Prostate cancer

Chief investigators Professor Michael Jennings and Professor Daniel Kolarich were successful in obtaining funding from the Bourne Foundation to determine how the pan cancer marker NeuGc could be used in a PSA-specific manner to improve current prostate cancer tests to deliver earlier and more reliable detection from different body fluids. The highly promising results indicate that a combination test exceeds both accuracy and sensitivity in detection of prostate cancer compared to the currently available standard tests.

Acute lymphocytic leukemia (ALL)/ mixed-lineage-leukemia (MLL)

In collaboration with a team at City of Hope/Beckman Institute in Los Angeles, Professor Daniel Kolarich is investigating how glycosylation in ALL/MLL is associated with the pathogenesis and treatment resistance against standard drugs such as vincristine. Research efforts have discovered novel, hitherto not known glycosylation pathways identified to be unique to humans and missing in mice. These fundamental discoveries are expected to improve understanding of pre-clinical models and how translation of exciting pre-clinical outcomes can successfully be achieved into human trials.

Melanoma

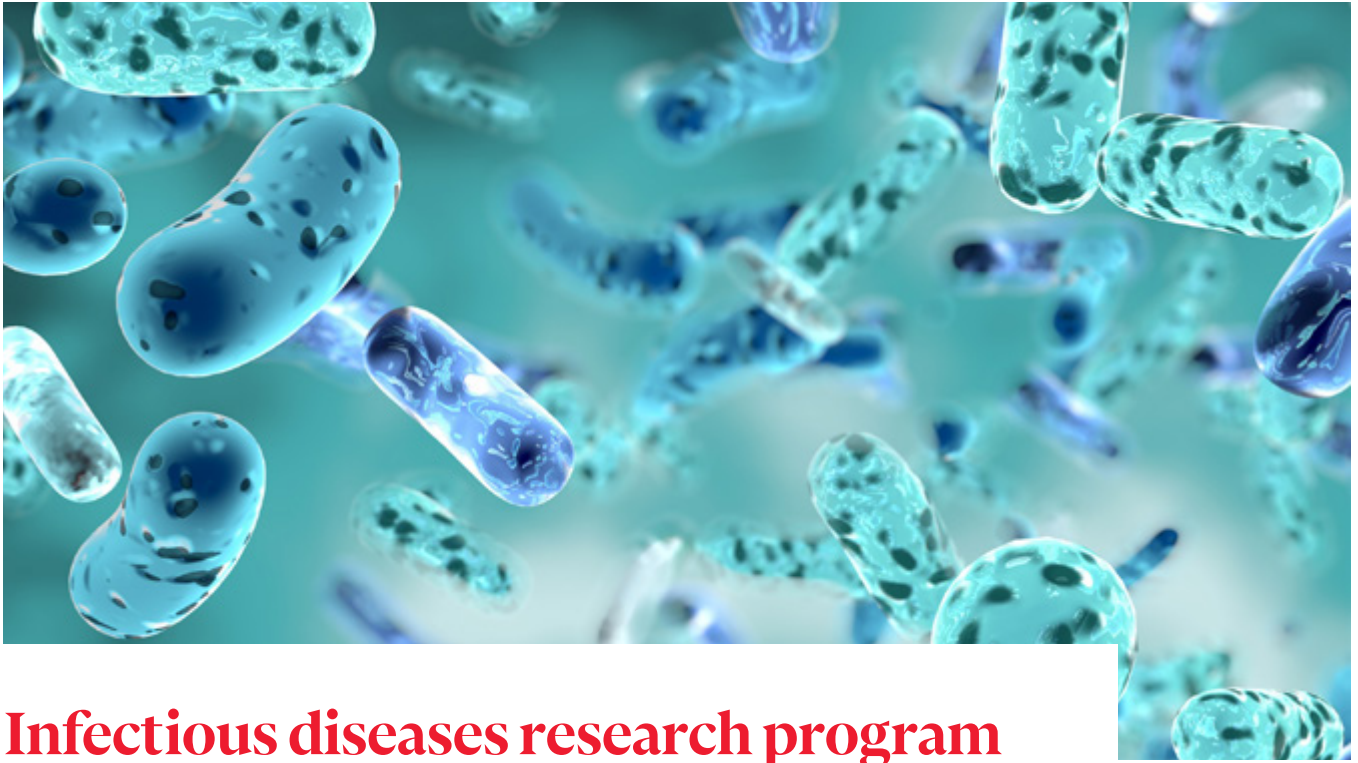
Professor Mark von Itzstein, Dr Arun Everest-Dass and Dr Andrea Maggioni have received funding from the Hay Family Benevolent Fund toward the Melanoma CellBank and a PhD Student Scholarship top up.

Colon and lung cancer

Professor Mark von Itzstein, Professor Daniel Kolarich and Dr Arun Everest-Dass have received funding from T&C Investments Pty Ltd for a PhD Student Scholarship top up toward the project *Transforming Early-Stage Diagnostics for Colon and Lung Cancer*.

Glycosylation and the production of red blood cells

Professor Daniel Kolarich, Dr Larissa Dirr and Dr Alpesh Malde along with Dr Rebecca Griffiths were awarded an Australian Research Council (ARC) Discovery Projects grant for their research project, "*The role of protein glycosylation in erythropoiesis*". This project, in collaboration with the Australian Red Cross Lifeblood, aims to understand how the sugar code of key-signalling proteins influences the development of red blood cells. This project expects to generate new fundamental knowledge in the area of stem cell signalling by innovative integration of biological and computational molecular characterisation techniques. In the long run this project will have implications for the treatment of cancer patients, as a key outcome of this research is the improvement of the *ex vivo* production of red blood cells for transfusion purposes, in particular for patients with rare blood groups for who normal blood supplies are difficult, if not impossible, to obtain.



Infectious diseases research program

Infectious diseases pose some of the world's most significant health challenges, claiming over 17 million lives globally every year.

There is an overwhelming need to find new ways to combat diseases caused by bacterial, viral, parasitic and fungal pathogens. The increasing emergence of antibiotic-resistance is also a global concern.

There's an urgent need to discover new approaches to address antibiotic-resistance and the lack of effective vaccines for some of the world's most serious viral and bacterial pathogens.

Our infectious diseases research program tackles these issues, combining our cutting-edge research equipment and facilities with our world-leading scientific expertise in the innovative field of glycomics. Our unique, multi-disciplinary approach to infectious diseases research provides us with a solid platform to discover and develop next generation drugs, vaccines and diagnostics to address some of the world's most debilitating diseases.

Bacterial infections

The Institute's research into the role of sugars and carbohydrates in diseases caused by bacteria represents new and exciting opportunities for the discovery of next generation antibiotics and vaccines. Many of the bacteria that cause some of the world's most devastating diseases are rapidly developing resistance to antibiotics, and to this end we are also developing drugs that break anti-bacterial resistance. Types of bacterial infections included within our infectious diseases research program include Strep A/ rheumatic heart disease, tuberculosis, middle ear infections, gonorrhoea, meningitis, and gastroenteritis/food poisoning.

Viral infections

Diseases caused by viruses have plagued humanity for time immemorial. Unfortunately, drugs that combat viruses are extremely limited in number and are not broad spectrum. The Institute conducts research into viral infections such as hand, foot and mouth disease (HFMD), human immunodeficiency virus (HIV), influenza virus, human parainfluenza virus (hPIV), human metapneumovirus (hMPV), respiratory syncytial virus (RSV), Dengue virus, Ross River virus, Chikungunya virus (CHIKV) and other emerging alphaviruses. We seek to understand how sugars/carbohydrates are utilised in viral infections so that scientists can identify targets for the development of new drugs that will treat and cure these diseases.

Parasitic infections

Parasitic infections such as malaria still present as important public health challenges in tropical environments, with devastating socio-economic consequences in developing countries. It is now becoming clear that some of these parasites rely on carbohydrate-binding proteins for attachment and invasion of human host cells. Our research in this area will yield useful information for the design of diagnostic tools, vaccines and drugs to fight these diseases.

Fungal infections

Fungal infections constitute a broad range of common medical illnesses from a common superficial or mucosal infections to the more severe systemic invasive fungal infections that affect millions of people worldwide. Fungal infections can occur regardless of the immune status of the host. However, individuals with a compromised immune system are particularly at risk. The Institute is fighting invasive fungal infections through novel therapeutic approaches.

Some of the highlights of our infectious diseases research in 2023 include:

Malaria vaccine candidate

The 'whole parasite' malaria vaccine developed by the group led by Professor Michael Good and Associate Professor Danielle Stanistic passed a major hurdle with the completion of the formal toxicological evaluation of the vaccine by an independent clinical research organisation. It demonstrated that the vaccine was safe and well tolerated, important data that supports the progression of this vaccine candidate to a Phase I human clinical trial.

Babesia vaccine candidate

Using the technology which underpins the design of the malaria vaccine, Professor Good, Associate Professor Stanistic and team have developed a novel design for a Babesia vaccine. Babesiosis is a tick-borne disease, and while it does affect humans, in Australia it is predominantly a disease of cattle. The team received Australian Research Council funding to embark on a trial of the whole parasite vaccine, which will be able to be freeze-dried to a powder, facilitating easy uptake by farmers in remote parts of the country.

Strep A/rheumatic heart disease vaccine candidate

The Strep A/rheumatic heart disease vaccine developed by the group led by Professor Michael Good and Associate Professor Manisha Pandey is currently in Phase I trials in Canada. Preliminary data show that the vaccine is inducing very good antibody levels in vaccinated volunteers, and the group are now planning for follow-up trials in Australia to test vaccine efficacy. The Heart Foundation, the Snow Foundation, the Lowitja Institute, the Li Ka Shing Institute (Edmonton), and now the Leducq Foundation (Boston) are major supporters of the further clinical development of the vaccine.

A drug to treat sepsis

Clinical trials of the anti-sepsis drug candidate STC3141 discovered by Distinguished Professor Mark von Itzstein's group in collaboration with the Parish group at the Australian National University are on-going. The industry partner China Grand Pharmaceutical and Healthcare Holdings is developing this drug candidate and announced in 2023 that STC3141 reached the appropriate endpoint in a Phase Ib clinical trial for safety, tolerability, and pharmacokinetics in Australia and Belgium, providing the foundation for further clinical studies. Phase II clinical trials for the treatment of sepsis (in China) were approved and commenced in late 2023.

Gonorrhoea vaccine candidate

Dr Freda Jen and Dr Ibrahim El-Deeb were awarded a \$1.38 million 2023 National Health and Medical Research Council (NHMRC) Ideas Grant for the project entitled "*Combating multidrug-resistant gonorrhoea by breaking down bacterial metal homeostasis*".

Professor Kate Seib's group and their collaborators are characterising new vaccine and drug targets for gonorrhoea. They are also running two clinical trials across seven study

sites in Australia to evaluate whether the 4CMenB vaccine that is licenced to prevent invasive disease caused by *Neisseria meningitidis* is able to provide cross-protection against the closely related bacterium *N. gonorrhoeae*.

HIV

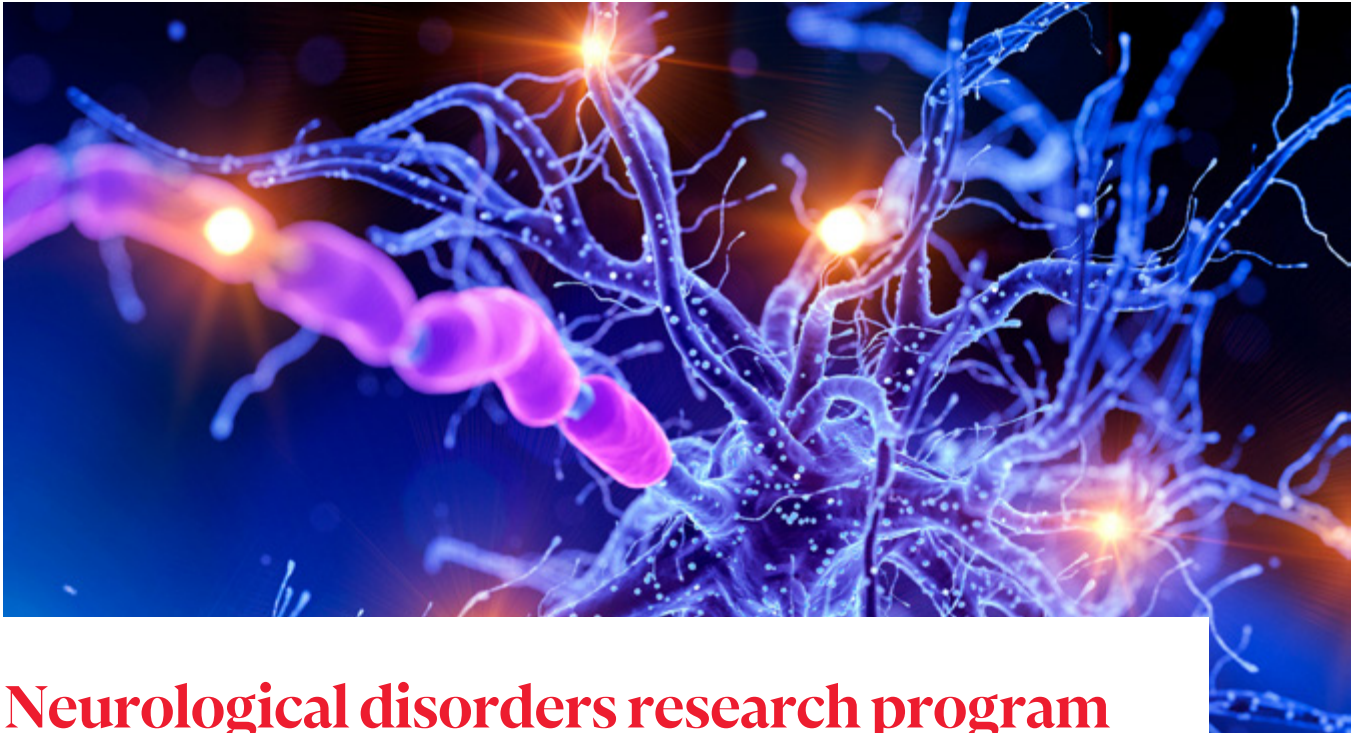
Professor Johnson Mak's lab were awarded a US NIH R21 grant to investigate the biology of vaginal microbes to see if they either act as the first line of defence by trapping HIV to deny it access to infect the host, or if it hitch-hikes across the sub-epithelial barrier to gain access to the host.

The role of protein glycosylation in erythropoiesis

Professor Daniel Kolarich, Dr Larissa Dirr and Dr Alpesh Malde along with Dr Rebecca Griffiths were awarded an Australian Research Council (ARC) Discovery Projects grant for their research project, "*The role of protein glycosylation in erythropoiesis*". This project, in collaboration with the Australian Red Cross Lifeblood, aims to understand how the sugar code of key-signalling proteins influences the development of red blood cells. This project expects to generate new fundamental knowledge in the area of stem cell signalling by innovative integration of biological and computational molecular characterisation techniques.

Antifungal drug development

A scientific milestone in the work of PhD student Danielle Lee, supervised by Associate Professor Thomas Haselhorst, was the successful development of a novel NMR-based enzyme assay monitoring the reaction of the UDP-galactose-pyranose mutase (Ugm) from *Aspergillus fumigatus*, an attractive target for antifungal drug development. Using this novel NMR assay, Danielle has demonstrated that the three novel lead compounds she has previously identified as potent antifungal drugs strongly inhibit this fungal enzyme, validating this target for drug discovery. In collaboration with Professor Joe Tiralongo, Danielle was also heavily involved in setting up a fungal host model using the greater wax moth *Galleria mellonella*. This model is particularly beneficial as it is inexpensive, easy to use, and does not require specialised infrastructure. *In-vivo* experiments utilising this model have demonstrated that the three new lead compounds that Danielle has identified in her PhD are non-toxic and significantly reduce fungal growth *in-vivo*.



Neurological disorders research program

The Institute's neurological disorders research encompasses the following key issues:

Axon degeneration research

Axons (nerve fibres) are the portion of the nerve cells that communicates with other cells by transmitting electrical and chemical signals. These signals underlie essential processes, such as thinking and memory, movement, language and sense of touch.

When axons are damaged, whether by injury, disease or as a side effect of certain drugs, a program is triggered to make axons self-destruct. This destruction likely plays an important role in multiple neurodegenerative conditions, including peripheral neuropathy, Parkinson's disease amyotrophic lateral sclerosis (ALS), traumatic brain injury and glaucoma. There are no current treatments that effectively target axonal breakdown.

The enzyme SARM1 is a central player in axon loss. In healthy nerve cells, SARM1 is present but inactive. Disease and injury activate SARM1, which results in rapid breakdown of the essential "helper molecule" nicotinamide adenine dinucleotide (NAD⁺) and ultimately destruction of the axon. Interestingly, similar NAD⁺ consuming enzymes are also found in bacterial immune systems that provide protection against viral (phage) infections.

SARM1 is a potential therapeutic target for many neurodegenerative diseases but, in order to exploit the full promise of targeting SARM1, detailed knowledge of the catalytic mechanism and the molecular mechanisms upstream and downstream of SARM1 enzyme activity is required.

Associate Professor Thomas Ve's research group is using structural biology methods such as cryo-Electron Microscopy and X-ray Crystallography, combined with cell and chemistry-based approaches in collaboration with national and international partners, to characterise SARM1 and related bacterial enzymes at the molecular level; define how they are regulated; and explore the diversity and targets of their nucleotide signals.

The research will unravel general principles of nucleotide-based signalling across all domains of life and will lead to

an improved understanding of the molecular mechanisms involved in SARM1 induced axon degeneration.

Importantly, the research will provide new strategies for design of targeted inhibitors of axon degeneration, which can be developed into therapeutic agents for neurodegenerative diseases.

Translation of this research is supported by a long-term research collaboration with Dr Ve's industry partner Disarm Therapeutics, a wholly owned subsidiary of Eli Lilly and Company, whose mission is to create breakthrough disease-modifying therapeutics to treat patients affected by axonal degeneration.

Mental health, PTSD, and pain research

Glycans play an integral role in the intercommunication of neurons in the brain. We know that for patients who experience pain, trauma and blast exposure, these glycans alter. Investigating this process, known as plasticity, is integral to better understanding, diagnosing and preventing acute neurological conditions transitioning to chronic disease.

Professor Carolyn Mountford is a world leader in the development of magnetic resonance (MR) technology to address unmet clinical needs. Her translational research in the neuro field centres on MR technology to identify neurochemical changes to the brain associated with pain, Post-Traumatic Stress Disorder (PTSD), injury from blast and impact. Her team has now completed a contract to the USA and Australian military to develop an approach to improve the health of soldiers.

Professor Mountford's research team uses clinical 3T scanners to monitor the effect of trauma and pain on the human glycome. They have assigned seven fucosylated glycans in the human brain. These glycans are affected differently in men and women. They are also affected differently by chronic pain, PTSD, and blast exposure. The glycans have been shown in animal models by a Caltech team to be implicated in the mechanisms underlying neuronal development, learning and memory and regulation of the nervous system development and neuronal processes.



The International Consortium for Anti-Infective Research (iCAIR®)

In 2017, the International Consortium for Anti-Infective Research (iCAIR®) was established. This is a major international partnership between Australia's Institute for Glycomics and Germany's Fraunhofer Institute for Toxicology and Experimental Medicine in Hannover, the Institute for Clinical Biochemistry at the Hannover Medical School (MHH), and Helmholtz Centre for Infection Research.

The Consortium aims to discover new treatments to combat respiratory viruses including SARS-CoV-2, influenza virus and respiratory infection-causing bacteria and fungi.

Infectious diseases and antibiotic resistance are a global, and potentially deadly threat. Previously effective antibiotics are becoming less and less effective against multi-resistant bacteria, and there is an urgent need to develop new drugs and treatments to combat infection.

The biggest hurdle in developing new medications is getting them from the laboratory into clinical trials, bridging the gap from the discovery of new agents to their development by the pharmaceutical industry into potential medications.

iCAIR® is working on the development of anti-infective therapies that take new treatment options all the way from the identification of potentially beneficial substances to the preclinical proof of concept. The alliance establishes a development platform that covers all the steps of a targeted drug development process, from identifying potential points of attack, right through to drug design and efficacy testing.

In 2023, we continued to apply the use of advanced in vitro Human Airway Epithelium (HAE) and ex vivo human Precision Cut Lung Slice (hPCLS) to our ground-breaking respiratory infection drug discovery and development programs. These advanced models, which use cells and tissues from human donors, hold much potential to streamline and improve the biological relevance of our work. Further, as an Institute committed to the ethical principles of the Australian Code for the Care and Use of Animals for Scientific Purposes, these advanced models also provide clear animal welfare advantages.





**REMARKABLE
ACHIEVEMENTS**



Professor Michael Jennings awarded NHMRC Investigator L3 Grant

Professor Michael Jennings was awarded the \$2.95 million 2023 NHMRC Investigator L3 Grant, the highest investigator grant offered by the NHMRC, for his project entitled "Discovery and exploitation of glycointeractions to create new opportunities to diagnose, prevent and treat disease".



Professor Michael Good AO awarded the 2024 Dr. John Raftos AM Award for Advancing Innovation

Professor Michael Good AO was awarded the 2024 Dr. John Raftos AM Award for Advancing Innovation by the National Foundation for Medical Research and Innovation (NFMRI).

This Award is offered every two years to an existing or past NFMRI grant recipient for an outstanding contribution towards the development and advancement of a biomedical innovation related to the nature, prevention, diagnosis, treatment and incidence of disease and other health problems that have a significant impact on the health of humans. The medal is awarded with a prize of \$50,000 in the form of a grant to support the recipient's research.



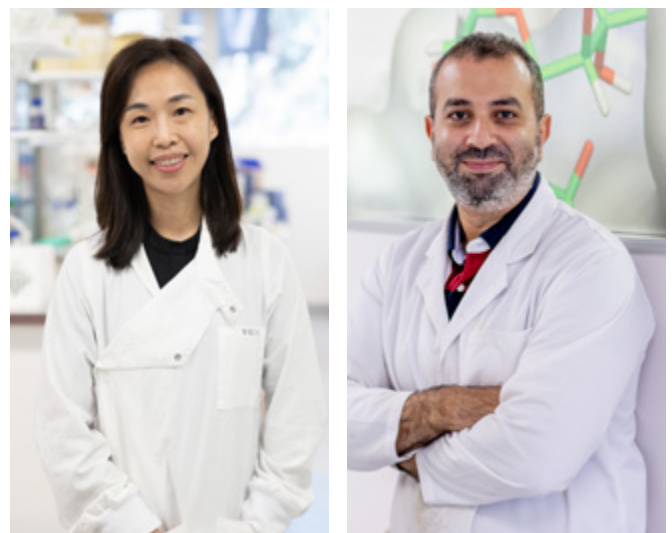
Image credit Department of Industry, Science and Resources.

Associate Professor Lara Herrero awarded the Prize for New Innovators in the 2023 Prime Minister's Prizes for Science

Associate Professor Lara Herrero received the Prize for New Innovators in the 2023 Prime Minister's Prizes for Science.

She is recognised for creating a world-first drug with the potential to treat inflammatory musculoskeletal diseases with long-term debilitating symptoms, such as Ross River virus. Her home-grown discovery has been commercialised in partnership with an Australian biotechnology company and is now improving the lives of millions of people worldwide who experience viral arthritis, including the thousands of Australians suffering from RRV each year.

Associate Professor Herrero was also invited to be an editor for Clinical Microbiology Reviews.



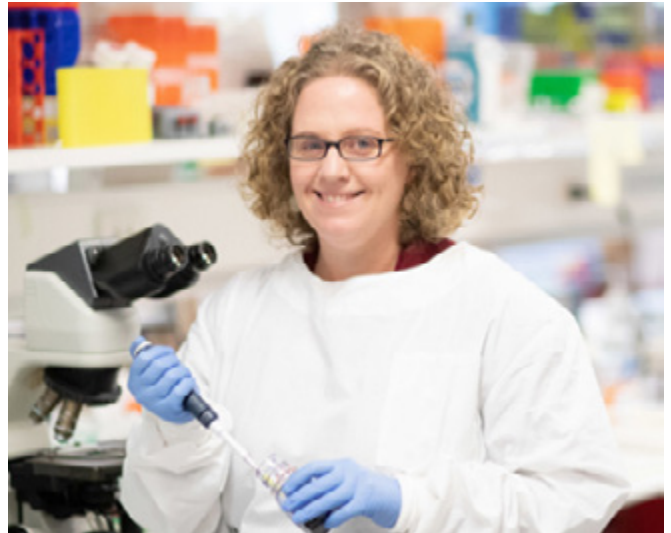
Dr Freda Jen and Dr Ibrahim El-Deeb Awarded a 2023 NHMRC Ideas Grant

Dr Freda Jen and Dr Ibrahim El-Deeb were awarded a \$1.38 million 2023 National Health and Medical Research Council (NHMRC) Ideas Grant for the project entitled "Combating multidrug-resistant gonorrhoea by breaking down bacterial metal homeostasis".



Professor Nicki Packer awarded a 2023 NHMRC Ideas Grant

Professor Nicki Packer was awarded a \$1.18 million 2023 National Health and Medical Research Council (NHMRC) Ideas Grant entitled "*Inhibition of Asialoglycoprotein Receptor 1: a novel strategy for atherosclerosis prevention*" (Grant awarded through University of Adelaide).



Associate Professor Danielle Staniscic joins The Australian Academy of Health and Medical Sciences' mentorship program

Associate Professor Danielle Staniscic was named as one of fifteen rising health and medical research stars to join The Australian Academy of Health and Medical Sciences' mentorship program.

The AAHMS mentorship program was launched shortly after the Academy's inception in 2015, with a goal of nurturing future leaders and supporting them in their careers. The latest intake brings the total number of mentees who have taken part in the program to 100.

Associate Professor Danielle Staniscic's article, "*Development and Evaluation of a Cryopreserved Whole-Parasite Vaccine in a Rodent Model of Blood-Stage Malaria*" was featured in ASM Journals' published collection in recognition of World Malaria Day.



Associate Professor Thomas Haselhorst selected as assessor for the MSCA4Ukraine scholarship program

This initiative was created by the European Union in collaboration with the Alexander von Humboldt Foundation for researchers who have fled the Ukraine. 25 million Euro have been made available for this program. The MSCA4Ukraine scholarship program enables researchers to continue their work at a scientific or non-scientific institution in an EU member state or a Horizon Europe associated state and helps them to maintain their links with research and innovation sites in Ukraine. In addition, the program facilitates the reintegration of researchers in Ukraine as soon as a safe return is possible, in order to counteract permanent brain-drain. Assessors of this program actively contribute to strengthening Ukrainian universities and research institutions and their cooperation and exchange with the international research community.



Associate Professor Milton Kiefel and team awarded Griffith University PVC Sciences Award

Associate Professor Milton Kiefel was part of a team awarded the Griffith University PVC Sciences Award for "*Excellence in Promoting Industry Engagement in Graduate Research by an Individual or Team*". Members of the team included: Jeremy Brownlie, Marde Helbig, Rebecca Ford, Sharon Saunders, Raya Monteiro, Ruth Kamrowski, and Brooke Cotton.



Professor Michael Jennings recognised as Australia's Field Leader in Biochemistry

Professor Michael Jennings, was recognised as one of Australia's top 250 researchers in 2024 in The Australian's 2024 Research Magazine.

The 2024 Research Magazine celebrates the excellence of Australian research by delving deep into the data and identifying the top researcher in 250 fields of research.

Professor Jennings was named the top researcher in the field of Biochemistry, within the discipline of Chemical and Material Sciences, for the second year running, based on the number of citations for papers published in the top 20 journals in the field over the past five years.



Dr Emil Johansson awarded an international postdoc grant by the Swedish Research Council

Dr Emil Johansson, one of the Institute's visiting research fellows from Sweden, was awarded a 3,600,000 SEK (Swedish krona) international postdoc grant within medicine and health by the Swedish Research Council.

Emil's 3-year international project aims to explore proteolysis targeting chimeras (PROTACs) as a new strategy to develop broad-spectrum antiviral agents, and he is mentored by Professor Mark von Itzstein AO.



Associate Professor Thomas Ve

Associate Professor Thomas Ve received confirmation of continuing appointment with Griffith University, on the back of outstanding performance.

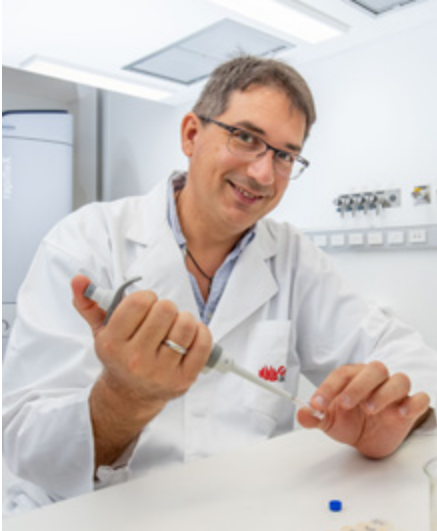
Associate Professor Thomas Ve is a structural biologist and a research leader at the Institute. He is also an ARC Future Fellow, and NHMRC Investigator. He has published over 50 papers including in Science, Molecular Cell, Neuron, Cell Host & Microbe, Nature Structural and Molecular Biology, Nature Communications, PNAS and PLoS Pathogens. He is currently the President of the Queensland Protein Group.



Danielle Lee presented at the Fungal Update: Mycology 2023 in London

Danielle Lee attended the Fungal Update: Mycology 2023 in London where she presented her poster – *Discovery of new antifungal agents in the fight against invasive fungal infections* – and won 2nd place. She also visited Hannover Medical School in Germany where she presented a seminar on her research to the Biochemistry department as part of the International Consortium for Anti-Infective Research (iCAIR) collaboration.

Danielle Lee also presented at the Queensland Protein group and Ross Smith ECR Award Symposium held at the Queensland Brain Institute, University of Queensland, as a selected student finalist.



Research Scientists awarded Australian Research Council Discovery Projects Grant

Professor Daniel Kolarich; Dr Larissa Dirr; Dr Alpesh Kumar Malde and Dr Rebecca Griffiths were awarded \$812,177 in the Australian Research Council (ARC) Discovery Projects grant scheme.

This project aims to understand how the sugar code of key-signalling proteins influences the development of red blood cells. This project expects to generate new fundamental knowledge in the area of stem cell signalling by innovative integration of biological and computational molecular characterisation techniques. The expected outcomes of this project include the development of novel workflows to study key regulators of cell development and the generation of new knowledge in stem cell signalling that will find applications in transforming stem cell therapies and associated research for future applications such as the laboratory manufacturing of red blood cells to close the availability gap for transfusion purposes.

Staff promotions



Associate Professor Daniel Kolarich promoted to Professor

In recognition of his outstanding commitment to advancing research and contributing to the excellence of our institute, Associate Professor Daniel Kolarich was promoted to Professor and Principal Research Leader.



Dr Carie-Anne Logue appointed as Higher Containment Facility Manager of Griffith's newly established PC3 Core facility

After well over a decade of dedicated service to the Institute as Senior Operations Manager, Dr Carie-Anne Logue was appointed as Higher Containment Facility Manager. The PC3 Facility has been under the Institute's management since its inception. It has now been established as a University Core Facility within the DVC(R) portfolio.



Institute for Glycomics Student Scholarship Awards

Each year, the Institute for Glycomics offers a number of prestigious student scholarships open to both honours and masters students wishing to undertake a research project within the Institute.

The 2023 Scholarships Presentation Evening was held on 17 April. We welcomed friends, family and peers to help celebrate the achievement of our scholarship recipients. We congratulate them all and thank our generous supporters: Community Bank Paradise Point, Warren and Sally von Bibra, and the Glycomics Circle whose gracious sponsorship of these awards allows students to realise their hopes and dreams of becoming the nation's future scientists!

Community Bank Paradise Point Glycomics Summer Scholarships

The Institute for Glycomics Community Bank Paradise Point Summer Scholarships are generously funded by the Community Bank Paradise Point Branch of Bendigo Bank.

The 2022/23 scholarships were presented by Brandon Hockley and Cassandra Hugonnet from Community Bank Paradise Point, Pimpama and Ormeau.

The recipients were:

Maina Macharia

David Song

Eric Minotte

Sukwhee Kim

Sean Miller

Jasmeen Kaur

Cassia Conceicao Goulart

Yuet Ang

Megan Young

Rachael Djordjevi

Glycomics Circle Summer Scholarships

The Glycomics Circle Summer Scholarships are generously funded by the Glycomics Circle.

The 2022/23 Glycomics Circle Summer Scholarship awards were presented by the Honorary Leneen Forde AC to the following recipients:

Thanh Huynh

Dominique Marando

Selena Guglielmi

Ashleigh Wellins

Glycomics Student Scholarship

The 2023 Glycomics Student Scholarship was presented by Professor Mark von Itzstein to:

Menace Gallagher

Sally and Warren von Bibra Student Scholarships

Sally and Warren von Bibra are loyal supporters of the Institute for Glycomics and have been generously sponsoring this prestigious scholarship scheme since 2003.

Sally and Warren were both in attendance to present the scholarship to:

Lindsay Gee

Glycomics Circle Masters Scholarship

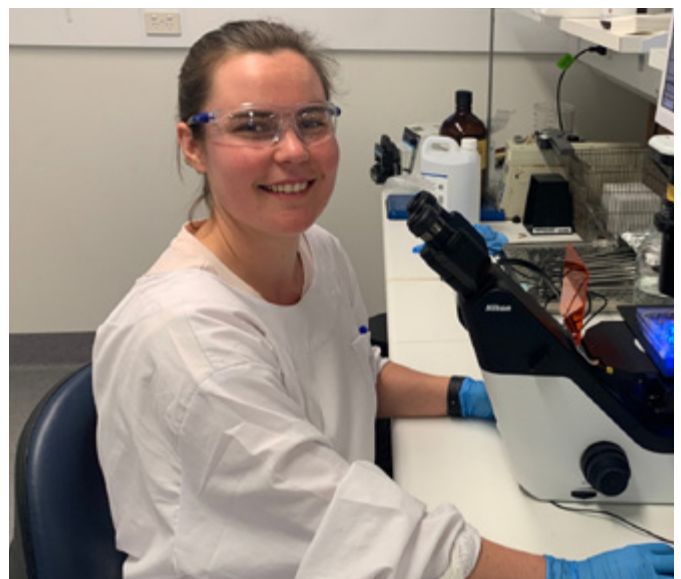
Every year, members of the Glycomics Circle make a financial contribution to empower the Institute's women in science through scholarships, grants and research support.

The 2023 Glycomics Circle Masters Scholarship award was presented by the Honorary Leneen Forde AC to:

Skye van Esch

After the awards presentation, Institute for Glycomics Advancement Manager, Nina Kristensen interviewed our Sally and Warren Von Bibra Student Scholarship recipient, Lindsay Gee, pictured below.





2023 Institute for Glycomics Research Excellence Awards

Every year the Institute for Glycomics conducts the Glycomics Research Excellence Awards scheme to acknowledge and reward outstanding researchers in a number of categories. Winners from these categories go on to compete in the Vice Chancellor's Research Excellence Awards scheme, alongside other researchers from various institutions across Griffith University.

The 2023 Research Excellence Awards winners were:

Director's Medal in recognition of an outstanding Doctor of Philosophy thesis

Joint recipients:

Dr Zachary Phillips

(supervised by Dr John Attack and Professor Michael Jennings)

Dr Annelies Van Den Bergh

(supervised by Professor Mark von Itzstein, Dr Larissa Dirr and Dr Patrice Guillon)

Peter Gallagher Memorial Glycomics Fellowship

In memory of Peter Gallagher, every year at the Glycomics Public Forum an internationally renowned researcher in the field of glycoscience is presented with the Peter Gallagher Memorial Glycomics Fellowship in recognition of their outstanding achievements in the field. In 2023, this prestigious Fellowship was presented to Professor Todd Lowary. Professor Lowary is a world leader in Chemical Glycobiology, in particular in the production of unique bacterial carbohydrates and using these sugars to better understand how bacteria produce and utilise these structures.



2023 Institute for Glycomics 3 Minute Thesis competition

Three Minute Thesis (3MT) is an academic competition that challenges Higher Degree Research candidates to describe their research within three minutes to a general audience. The 3MT is held at many universities across Australia, New Zealand and Asia, culminating in an Asia-Pacific 3MT Final. The competition aims to professionally develop the presentation and research communication skills of all participants, honing their ability to effectively explain their research in a language that can be understood by a non-specialist audience.

Special commendations to our 3MT competitors:

Valentin Slesarenko
 Ashley Fraser
 Alex Johnston
 Caroline Thng
 Habeebah Owolabi

Congratulations to the following winners who progressed to the next stage of the competition:

Ashley Fraser – Post confirmation PhD winner
 Alex Johnston – Pre-confirmation PhD winner
 Habeebah Owolabi – Honours/Master of Medical Research/
 Master's winner and 2023 People's Choice award winner



Postdoctoral Fellowship Scheme

Institute for Glycomics Early Career Researchers secured the Griffith University Postdoctoral Fellowship Scheme:

Oren Cooper for his project titled "*Glycan-based nanotechnology for the development of prebiotic approaches to increase food safety in Australia*", working with Associate Professor Thomas Haselhorst and Dr Chris Day, and Wesley Freppel for his project titled "*Flaviviruses and the brain: towards the development of novel therapeutics for arboviruses of pandemic potential*."



Student completions

Student	Thesis title	Supervisor/s
Chengpeng Li	<i>Versatile bridges of bithiophene: synthesis, dual-state emission, and photochromism</i>	Associate Professor Milton Kiefel
Nusrat Nahar	<i>Characterisation of gene expression and virulence factors in Actinobacillus pleuropneumonia</i>	Dr John Attack and Professor Michael Jennings
Elina Panahi	<i>New insights into the unique Australian Leishmania macropodum parasite: Investigations into the animal and human seroprevalence, human immune responses and transmitting vector</i>	Associate Professor Lara Herrero and Professor Michael Good AO
Winter Okoth	<i>Development and Pre-clinical Evaluation of Whole Blood-Stage Malaria Vaccine using Cationic Liposomes</i>	Associate Professor Danielle Stanisic and Professor Michael Good AO
Peter Sunde-Brown	<i>Synthesis of Thiolactulose and 1-Deoxymannojirimycin from D-fructose using the Mitsunobu reaction</i>	Associate Professor Todd Houston and Professor Helen Blanchard
Olivia Tan Hui	<i>Structure Determination of Human Parainfluenza Virus Type 1 Haemagglutinin-Neuraminidase and Antiviral Drug Design</i>	Professor Mark von Itzstein AO, Associate Professor Thomas Ve, Dr Patrice Guillon and Dr Larissa Dirr
Annelies Van Den Bergh	<i>The human metapneumovirus and its interactions with the host cell surface receptors</i>	Professor Mark von Itzstein AO, Dr Patrice Guillon, Dr Larissa Dirr and Dr Ben Bailly
Abarna Vidya Mohana Murugan	<i>Understanding host-pathogen co-evolution using state-of-the-art glycomics</i>	Professor Daniel Kolarich and Professor Joe Tiralongo
Jing (Jackie) Wang	<i>Detection of Neu5Gc tumour antigens</i>	Professor Michael Jennings, Dr Lucy Shewell and Dr Christopher Day
Yuan Zhang	<i>Characterization of Pilin phosphorylcholine modification in Neisseria meningitidis</i>	Professor Michael Jennings and Dr Freda Jen

Our rich and enabling research environment provides exceptional Honours, Masters and PhD education programs for the nation's future scientists.



A close-up photograph of a scientist in a laboratory setting. The scientist is wearing a white lab coat, a blue hairnet, and clear safety goggles. They are looking through the eyepiece of a microscope. The background is a blurred laboratory environment with other people in blue scrubs. The overall color palette is dominated by blues and whites, creating a clean and professional atmosphere.

TRANSLATION AND COMMERCIALISATION

We have an outstanding track record in translating biomedical discoveries to the clinic; delivering life-saving diagnostics, preventions and cures to those who need them most.



Translation and commercialisation of world-leading science

Following in the footsteps of his success with Relenza, Distinguished Professor Mark von Itzstein's vision when founding the Institute was to create an environment that enables the translation and commercialisation of world leading research, delivering life-saving diagnostics, preventions and cures to those who need them most. This vision remains a driver and focus for all of our members, from undergraduate students to Principal Research Leaders and administrative support staff.

The Institute's Business Team, led by General Manager, Dr Chris Davis, has developed a robust platform for packaging and commercialising Institute technologies, with a particular focus on establishing deep partnerships with Industry through licensing and co-development programs. This approach provides multi-faceted benefit to internal research programs including income diversification, capability building, attracting and retaining a highly skilled workforce, strong technical and commercial guidance from a product development and demand perspective from industry partners, as well as ensuring smooth technology transfer to give each technology the best chance of success en route to market. Additionally, the Institute's business personnel support the research cohort with their expertise in intellectual property, technology packaging, negotiation and deal making, preclinical and clinical technology development and post-deal project management.

In 2023 we gained significant steps in the translation of Institute research both internally and by our commercialisation partners:

Packaged and initiated fundraising for two technologies for commercialisation through company vehicles (Griffith University spin-out companies), expected to be completed in 2024.

Our **Strep A vaccine** candidates entered a Phase I clinical trial in Canada and the data generated to date has been extremely encouraging. In 2023 this program received a \$5 million boost in funding through a new partnership with the Leducq Foundation to support future clinical development, including a Phase Ia/b clinical trial to begin in Australia in

2024. A further \$9 million is under negotiation to support the manufacture and Phase I clinical development of the technology, with these negotiations expected to be successfully closed during the course of 2024. Additionally, our China territory licensee partners at Olymvax Biopharma are on track to initiate a Phase I clinical trial in China in 2024 having completed manufacture and a Phase I/II clinical trial application to the Chinese regulator, the NMPA, in 2023.

Grand Medical Pty Ltd, our commercial partners and technology licensee via ANU for a **drug candidate to treat sepsis**, began recruiting for their Phase II clinical study to evaluate efficacy in sepsis patients. This follows completion of a Phase Ib trial in Australia and Belgium to evaluate the safety, tolerability, drug metabolism characteristics and preliminary effectiveness of STC3141 in the treatment of sepsis patients with different degrees of renal impairment in intensive care unit. The trial showed the drug candidate has a favourable safety profile and was well tolerated. Positive efficacy signals were also observed. The drug molecule was invented by the von Itzstein Group several years ago. Preclinical development of our **drug candidate for parafllu**, also invented by the von Itzstein Group, continues in cooperation with technology licensee Grand Medical Pty Ltd.

Australian commercial partner ASX listed company partner and technology licensee Inoviq continues to build on the Institute's **SubB2M cancer detection platform**, demonstrating in independent validation studies that their SubB2M/CA15-3 test outperforms a leading commercially available test for breast cancer.

Paradigm Biopharma, licensee of our **repurposed drug for the treatment of alphaviral-induced arthritis** have made Zilosul® available to patients, through the TGA's Special Access Scheme.

We continue to work with our commercial partner and technology licensee Limmatech Biologics, to advance the preclinical development of a **vaccine to prevent gonorrhoea**. Successful fundraising initiatives aims to accelerate this candidate to the clinic.



Internationalisation

Global collaboration has been at the forefront of our Institute's mission since inception. It is essential to achieving our vision to bring forward novel drugs and vaccines to the community.

As highlighted throughout this report, we continue to collaborate with other leading research organisations and industry worldwide who share our commitment to fighting diseases of global impact.

Our unique research expertise makes us the only institute of its kind in Australia and only one of a handful in the world. This is backed by a professional and flexible approach to collaboration that makes us an ideal partner for research and commercialisation.

Some examples of our international collaborative efforts include:

- **France and USA** – investigating glycomics platforms to aid in vaccine development with industry partner Sanofi.
- **Germany** – developing new solutions to treat respiratory disease through iCAIR®, the International Consortium for Anti-Infective Research, with partners Fraunhofer ITEM and the Hannover Medical School.
- **Canada** – conducting a Phase 1 clinical trial in Canada on Professor Michael Good's Strep A vaccine candidate with clinical development partner the Li Ka Shing Institute.
- **Norway** – understanding the glycomics of breast cancer with collaborative partner Stavanger University Hospital.
- **Hong Kong** – developing influenza virus and SARS-CoV-2-CoV-2 inhibitors with partners at The Hong Kong Polytechnic University
- **Switzerland** – co-developing a world-first vaccine for gonorrhoea with biotech partner Limmatech Biologics.
- **USA** – identifying new therapeutics for neurodegenerative diseases with multinational industry partner Lilly.
- **Mainland China** – developing a world-first therapeutic for human parainfluenza with industry partner China Grand Pharma, based in Wuhan, through their Australian entity Grand Medical.
- **Denmark** – developing new vaccines for infectious diseases in humans and animals with Statens Serum Institute.
- **Singapore** – developing new drugs against dengue virus infection with collaborative partner National University Singapore.
- **Tanzania** – developing new tools to investigate malaria infection in humans with partners at the Ifakara Health Institute.
- **Japan** – understanding the glycomics of cancer with collaborative partners at Kumamoto University.



Commercialisation case study

Author: Emma O'Connor, Marketing and Communications, Griffith University

World-first human challenge trial to test efficacy of Strep A and rheumatic heart disease vaccine

Griffith University's Institute for Glycomics has received a \$5 million philanthropic donation from the International Leducq Foundation to further the development of a vaccine to prevent Strep A infection and rheumatic heart disease in a world-first expanded clinical trial.

As part of the research program, and in collaboration with researchers at the Murdoch Children's Research Institute, volunteers will be vaccinated and then given a deliberate Strep A infection to test the vaccine.

The research will lead to Phase II studies where hundreds of volunteers will be vaccinated and followed to test the efficacy of the vaccine in a real-world setting.

Griffith University Vice Chancellor and President Professor Carolyn Evans said this generous funding from the Leducq Foundation is one of the largest philanthropic donations the university has ever received.

"As a university, we are incredibly proud of the work being done by the Institute for Glycomics and to test the vaccine through a controlled live dose of the bacteria will be groundbreaking for the medical world," Professor Evans said.

"Leducq Foundation is a great partner to have on board as its mission is to improve human health through international efforts to combat cardiovascular disease and stroke."

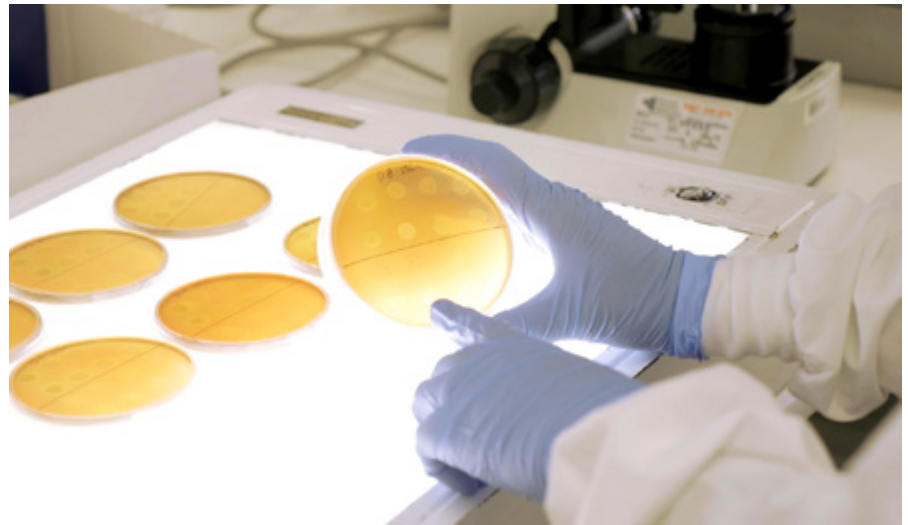
Lead researcher Professor Michael Good AO and Associate Professor Manisha Pandey, both from the Institute for Glycomics, discovered Strep A's Achilles heel to help prevent not only Strep A infection but also rheumatic heart disease.

"A human clinical trial, which started in November, is currently underway in Canada at the University of Alberta where volunteers are receiving the vaccine to test for safety and immunogenicity," Professor Good said.

"The vaccine, developed by Griffith University, is designed around key immune determinants, defined by the research team, which represent the organism's Achilles heel.

"In pre-clinical research the vaccine has been shown to protect against all strains of Strep A that have been tested.

"There is currently no vaccine available for rheumatic heart disease and Strep A, and natural immunity takes years to develop."



Strep A is responsible for rheumatic heart disease and many cases of deadly invasive disease and toxic shock.

In Australia, Aboriginal and Torres Strait Islander people suffer the highest rate of rheumatic heart disease in the world.

It is estimated that around 500,000 people die each year as a result of Strep A infection.

Associate Professor Pandey said the funding from the Leducq Foundation will go a long way towards the continued development of the vaccine candidate through Phase I human clinical trials.

"This is ground-breaking medical research in which we will be able to test a Strep A vaccine in a human challenge trial," she said.

"This next step will be crucial to test the efficacy of the vaccine in healthy participants.

"Following on from this, our research will then pave the way for a comprehensive testing strategy where we identify the optimal dose of the vaccine to take into a Phase II clinical trial."

Dr David Milan, Leducq Chief Scientific Officer, said that supporting this effort to develop a Strep A vaccine falls squarely within the cardiovascular disease mission of the Leducq Foundation.

"Leducq is excited about the potential of a Strep A vaccine to reduce not only strep throat infections but downstream rheumatic heart disease, a major source of worldwide mortality, especially in low- and middle-income countries," Dr Milan said.

Professor Mark von Itzstein AO, Director of the Institute for Glycomics was delighted the Leducq Foundation had identified the Institute's vaccine candidate as an exciting opportunity.

"This significant financial support from the Leducq Foundation provides our researchers the capacity to progress the Institute's most advanced vaccine candidate in human clinical trials," Professor von Itzstein said.

"I am thrilled we will now undertake the next critical steps in our vision of producing a vaccine that will save many lives from the consequences of Strep A infection."

Professor Andrew Steer, Director of the Infection, Immunity and Global Health at MCRI said: "MCRI is excited to co-lead the human infection trial of the Griffith vaccine in Melbourne, a major milestone for Strep A vaccines in Australia and indeed the world."



Commercial partnership case study

Author: Emma O'Connor, Marketing and Communications, Griffith University

New Griffith University site for the Translational Science Hub brings global vaccine research and development to the Gold Coast

Sanofi, one of the world's leading healthcare companies, has progressed its partnership with Griffith University by officially opening its latest research site at the university's Gold Coast campus, which will bring global biomedical research and development (R&D) to the Coast.

The partnership forms part of the Translational Science Hub (TSH), an exciting collaboration that links world-class researchers in Queensland, and now the Gold Coast, with scientists at the Sanofi mRNA Centre of Excellence in France and the United States to develop the next generation of immunisations.

A first of its kind, TSH is a \$280 million partnership between Sanofi, the Queensland Government, Griffith University, and the University of Queensland that is putting the Sunshine State at the forefront of mRNA vaccine development and biomedical research in Australia.

Operating at the cutting-edge of science, Griffith University offers state-of-the-art technology and leading experts in infectious disease, vaccine development and mRNA technology, presenting strong foundations for successful research collaboration in mRNA science.

Queensland Deputy Premier Steven Miles said: "Queensland is home to world-class research facilities and a highly-skilled workforce driving the development of new vaccines and healthcare breakthroughs. The fact that Sanofi, one of the world's largest healthcare companies, chose Queensland to reshape 21st century medicine is a strong sign of things to come, and a significant milestone for the Gold Coast and Griffith University."

The Translational Science Hub will initially focus on the evaluation of a new generation of mRNA vaccines. mRNA is expected to herald new vaccines that instruct certain cells to produce proteins that are recognised by the immune system to mount a defence.

Griffith Vice Chancellor and President Professor Carolyn Evans said: "This partnership sees Griffith University as a burgeoning biotech hub on the Gold Coast, paving the way for research and discoveries that can change people's lives for the better. Griffith is already producing innovative research and a partnership of this ilk is a sign the Gold Coast is at the epicentre of groundbreaking science."



Researchers based on the Gold Coast will use Griffith University infrastructure and technology to better understand mRNA vaccine technology, which will help to optimise the platform to produce better vaccines and expand its use in the development of therapies to treat a variety of diseases.

First-of-its-kind vaccines for chlamydia, acne and even some cancers, plus improved vaccines for influenza and RSV, will be developed on the Gold Coast and across Queensland.

Griffith Deputy Vice Chancellor (Research) Professor Lee Smith said: "We welcome Sanofi and the Translational Science Hub to our Gold Coast campus. This partnership gives our researchers and students a unique opportunity to work on the very latest science with a global healthcare leader."

Sanofi operates 20 research and development sites around the world exploring new medicines and vaccines. This includes translational science, where researchers work to translate early observations in the laboratory into clinical results that directly benefit people.

Dr Iris Depaz, Managing Director TSH & Country Medical Lead, Sanofi Australia and New Zealand said: "The opening of this Gold Coast site is another important milestone for the Translational Science Hub. It provides a space for our scientists to be physically located close to our collaborators at Griffith University to facilitate engagement and exchange. We want to play a major role in growing the scientific ecosystem in Queensland because there is a strong talent pool of some of the brightest medical minds right here in the Sunshine State."

In Australia, Sanofi is a major supplier of 18 vaccines with eight on the National Immunisation Program (NIP). The company has over 50 medicines on the Pharmaceutical Benefits Scheme (PBS) and six rare disease therapies on the Life Saving Drugs Program. Sanofi also has a consumer health business and manufacturing facility located in Brisbane.



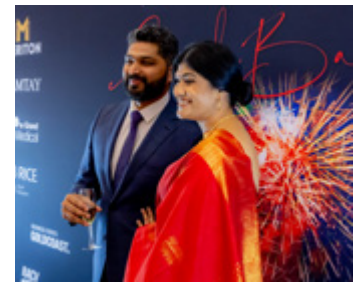
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**COMMUNITY ENGAGEMENT
AND REMARKABLE SUPPORT**



2023 Institute for Glycomics Grand Ball

The 2023 Institute for Glycomics Grand Ball was held on Saturday 7 October at RACV Royal Pines Resort.

The glamorous black-tie event welcomed over 400 guests who enjoyed a delicious three course meal, four-hour beverage package, exciting raffle and auction prizes, live entertainment all night, and an exclusive afterparty.

Thanks to the support of event partners, sponsors, prize donors, and all those who attended the event, over \$200,000 was raised in support of the Institute's research into finding new cures and preventions for diseases of global impact.

As part of her speech during the event, Griffith University's Vice Chancellor and President, Professor Carolyn Evans, also announced a significant donation of \$2 million from Mr Ray James to the Institute for Glycomics. As a long-standing supporter of Griffith University and the Institute's research, Mr James was recently inducted as an Honorary Fellow of the Institute for Glycomics – a highly prestigious recognition.

This year's Institute for Glycomics Grand Ball was a memorable affair, where guests were treated to an array of special feature performances by Opera Queensland, that included talented alumni of Queensland Conservatorium Griffith University.

Opera Queensland talent included Meg Washington, Katie Stenzel, Alex Raineri and Jason Barry-Smith. As well as performing multiple solos and duets, Jason Barry-Smith also assumed the role of this year's Master of Ceremonies.

Other entertainment included a spectacular fireworks display, pre-dinner entertainment from Griffith University's Young Conservatorium musicians, and ballroom entertainment from Magic Carpet Ride, one of Australia's favourite cover bands.

The Institute for Glycomics welcomes the community's support of this annual black-tie affair and attracted high profile event partners including Meriton Group (Platinum Partner), SAMTAY (Gold Partner), Grand Medical (Silver Partner), FB Rice (Bronze Partner), Opera Queensland (Feature Entertainment Partner), Destination Gold Coast (Lounge Sponsor), GET it Magazine and Luke Marsden Photo (Media and Support Partners).

The focus of this year's Institute for Glycomics Grand Ball was two-fold; to raise vital funds for the Institute's current and future biomedical research, and to acknowledge and formally farewell the Institute's Founder and Director, Professor Mark von Itzstein AO.

At the end of the year, Professor von Itzstein stepped down from his role as Director after 23 years of outstanding leadership and commitment.

Under his stewardship, the Institute has become a globally recognised centre for innovation, attracting top-tier talent, securing substantial funding, and producing ground-breaking discoveries that have transformative implications for human health.

Professor von Itzstein leaves behind a truly remarkable legacy but plans to continue his important research in the role of Distinguished Professor at Griffith University's Institute for Glycomics.



Glycomics Week

The Institute for Glycomics celebrates Glycomics Week annually. This full week of events aims to:

- celebrate the Institute's growing significant research successes, and the impact this research has in the world of infectious diseases, cancer, neurological disorders, vaccine and drug discovery;
- acknowledge the invaluable assistance from the Institute's local, national and international friends, donors and supporters;
- continue to develop new engagements with local schools, companies and the community.

Glycomics Week encompasses both the **Glycomics Public Forum** and **Student Forum**. The Institute for Glycomics **Grand Ball** is also held during Glycomics Week every year, which is a fitting way to end a busy and exciting week of activities.



Glycomics Public Forum

The Glycomics Public Forum is an annual forum held at the Institute for Glycomics. The general public is encouraged to attend this evening event to hear from a panel of experts from various fields that link back to the study of glycomics and its relevance to cancer, infectious diseases and neurological disorders research. The panel of experts' discussions are easy to understand, making this event suitable for anyone to attend.

This year, the panel of experts discussed "*Drugs and Vaccines – The journey from Laboratory Discovery to Pharmaceutical Product*", moderated by ABC Radio Presenter, Ms Nicole Dyer.

The 2023 panel included:

Professor Todd Lowary – Distinguished Research Fellow and the Director of the Institute of Biological Chemistry, Academia Sinica Taiwan.

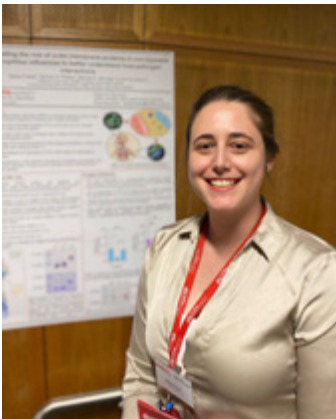
Dr Iris Depaz – Country Medical Lead ANZ at Sanofi.

Associate Professor Lara Herrero – Research Leader, Institute for Glycomics, Griffith University.

Professor Mark Smythe – Principal Research Fellow, Institute for Molecular Bioscience, University of Queensland and CEO at Infensa Bioscience Pty Ltd.

Dr Chris Davis – General Manager, Institute for Glycomics, Griffith University.

Guests were invited to ask the panel questions and after the event enjoy some light canapés and refreshments, with the opportunity to meet and converse with the panel and research scientists from the Institute for Glycomics.



Glycomics Student Forum

The Glycomics Student Forum is an annual, student-organised event which provides the Institute's postgraduates with an opportunity to present their hard-earned research accomplishments to the wider Institute and community and hone their presentation skills in preparation for future conferences.

This year's Student Forum included a presentation from keynote speaker Professor Todd Lowary as well as an insightful panel discussion entitled "*Unlocking Future Horizons: Career Development Pathways for HDR Students*". The panel enabled students to discover the pathways to a successful postgraduate journey as they heard from experienced professionals who shed light on the opportunities available to Higher Degree Research students.

The Glycomics Student Forum is supported by external suppliers and companies who, in turn, hold a Trade Display within the Institute for the duration of the day.





Fourth GO PINK month propelling breast cancer research forward

Breast cancer is one of the most common forms of cancer among women worldwide, with an estimated 2.1 million new cases diagnosed each year. The Institute for Glycomics partnered with Sanctuary Cove Golf and Country Club for a fourth consecutive year, who led fundraising efforts throughout the month of October for breast cancer research. The primary objective of this partnership is to raise funds for the Institute for Glycomics' breast cancer research efforts. Additionally, the partnership aims to raise awareness of breast cancer and to educate the community on the importance of early detection and treatment.

Sanctuary Cove Golf and Country Club is a well-known and respected organisation in the community, known for their charitable efforts and commitment to making a positive impact on the lives of those affected by breast cancer. In an effort to further support this cause, 31 days of well-attended activities, events, golf clinics and pink promotional items were created to bring the community together in a collective effort to contribute to world class breast cancer research happening right here on the Gold Coast. Engagement with our community is imperative to progressing our research and these events created a wonderful forum to discuss questions from attendees and the opportunity to partake in some of our current research programs.

Over the past four years, the Sanctuary Cove Golf and Country Club has raised more than \$160,000 for breast cancer research at the Institute for Glycomics. These funds have been used to support the Institute's research efforts in developing new drugs, vaccines, personalised treatment, and early detection diagnostics for breast cancer.

We are deeply grateful to Sanctuary Cove Golf and Country Club for their tireless fundraising efforts year on year, helping to propel our research forward as we move toward a cancer-free future for all.



In the race to save lives, Women in Racing partner with Institute for Glycomics to raise funds for important medical research

In the dynamic realm of Women in Racing, every season ignites a fervent passion for the sport of horse racing, and this year marked their 18th year since foundation. Led by Directors Jennifer Bartels and Baslyn Beel, this powerhouse community epitomises a profound adoration for horse racing and a dedication to effecting positive change in the world.

Women in Racing orchestrates an array of events throughout the year, providing ample opportunities for members to don their fascinators, catch up with old friends and new, and immerse themselves in the exhilarating ambience of horse racing. These events, including live auctions and raffles, consistently draw enthusiastic crowds and swiftly sell out.

Beyond the thrill of the races, Women in Racing endeavour to support research. In 2023, Women in Racing raised an incredible \$7,000 in proceeds from their events which went directly to the Institute for Glycomics.

"We are delighted to bolster the Institute for Glycomics in this manner," expressed Jennifer/Baslyn, representing Women in Racing. "Their pioneering work is pivotal in understanding, diagnosing and ultimately in the pursuit of curing ailments affecting countless individuals, and we are honoured to contribute our part."

Renowned for ground-breaking research in cancer, infectious diseases, and neurological disorders, the Institute for Glycomics stands as a beacon of hope. The funds raised by Women in Racing will bolster research projects aimed at discovering and developing novel drugs, vaccines, personalised treatments and early detection diagnostics.

Expressing gratitude for Women in Racing's unwavering support, Professor Mark von Itzstein AO, Director of the Institute for Glycomics, acknowledged their indispensable role in advancing research across the spectrum of cancer and infectious diseases.



Seated for success: the philanthropic pillar of biomedical breakthroughs

'No one has ever become poor from giving' – Anne Frank.

A quote cited from businessman and philanthropist Mr Raymond James and one which ignites deep reflection about the act of giving and the deep-seated feelings that this demonstration of support creates.

A walk down memory lane:

Ray has been a tremendous support for Griffith University and Institute for Glycomics with long-standing generosity to biomedical research in our fight against diseases of global impact. Supporting the Institute generally through the Director's strategic fund, Ray's dedication and support has been propelling research for nearly a decade.

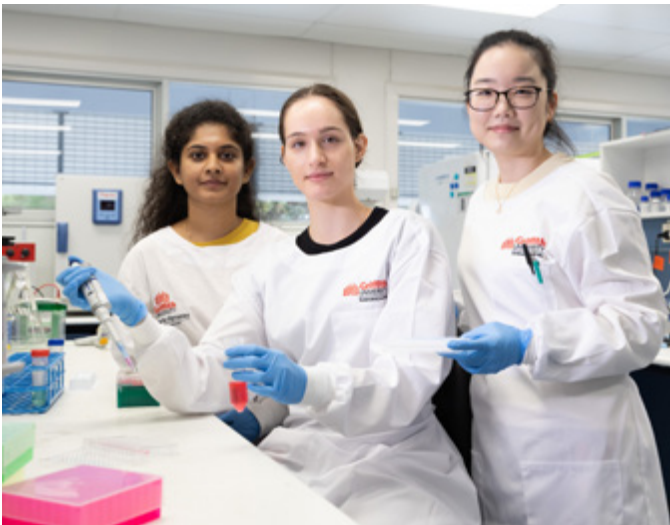
In 2022, Ray linked arms with the Malaria Vaccine Project, propelling the toxicology study forward, a critical juncture in the vaccine development. The Malaria Vaccine Project is proudly partnered with Rotary Club of 9640 and through Ray's generosity, he was acknowledged by the Rotary community, being inducted as a Paul Harris Fellow. The Institute for Glycomics invited Ray to be part of the esteemed Honorary Fellow cohort, reserved to those that have made significant impact to the Institute and their research through financial support and advocacy to the community. Ray was joined by his family and friends in a very special celebration evening as he was awarded his fellowship and unveiled on the Honorary Fellows board, prominently displayed in the entrance to the Institute.

A transformational gift for the future of global health:

This year Ray felt inspired to solidify the future of research and the leadership of biomedical research at Griffith University by providing a transformational gift of \$2,000,000 that will see Griffith University's first philanthropically funded Director's Chair, overseeing and leading biomedical research into the next decade.

“Personally, I cannot think of a better gift than one given to try and save the life of a young child. Vaccination has been a magic bullet in my lifetime. You can feel lost in giving to a big charity but your real charity gift is in your wallet or purse.” – Raymond James

Following on from the 23 years of the Institute's year-on-year growth, the financial support of the Director's Chair will provide the Institute the opportunity to attract another world-acclaimed researcher that will drive the Institute to another level of international recognition. The establishment of a sponsored Director's Chair, as a named Chair will ensure that the best-of-the-best is attracted to the position. Named Chairs exist in all major research universities, nationally and internationally and are highly sought after positions as they are seen as exceptionally prestigious appointments.



Empowering women in research: the Glycomics Circle paves the way for gender equality in science

The Glycomics Circle, an esteemed collective of women from across the Gold Coast community, celebrates its 9th anniversary of championing women in research. This exceptional group combines their annual contributions, to be able to offer scholarships, travel and conference grants, early career researcher assistance, and publication support, serves as a vital resource for women navigating the research landscape, from establishing careers to fostering collaboration and leadership.

Founded nine years ago by The Honourable Leneen Forde AC, the Glycomics Circle aims to empower women in research and advocate for gender equality within the Institute for Glycomics. Since its inception, the group has expanded its outreach, extending support to an increasing number of women across all career stages.

In 2023, the Glycomics Circle facilitated two student scholarships, enabling women from diverse backgrounds to pursue their studies and research without financial constraints. In the current climate, the opportunity for researchers to enjoy additional funding from the Glycomics Circle, enables them to focus on their amazing research and less on day to day expenses.

Beyond financial aid, the Glycomics Circle fosters a sense of community among women in the field. A particularly memorable Glycomics Circle gathering in 2023 brought together a group of four Glycomics female researchers with a wide variety of research areas, as well as from different stages in their research careers. A robust and insightful panel discussion allowed both researchers and our Glycomics Circle members to discuss the current state of affairs in medical research, the trials and tribulations of research funding, and the amazing work being conducted at the Institute.

The Institute for Glycomics acknowledges the significant contributions of the Glycomics Circle over the years, recognizing its pivotal role in supporting women in research. Looking ahead, the Institute eagerly anticipates continued collaboration with the Glycomics Circle, anticipating the positive influence on the lives and research endeavours of future generations of female scientists.



Maureen Stevenson: 2023 Queensland Community Philanthropist of the Year

A heartfelt congratulations to Maureen Stevenson for being honoured with the esteemed '2023 Queensland Community Philanthropist of the Year' award by the Queensland Community Foundation. This recognition is a testament to Maureen's exceptional dedication and remarkable contributions to philanthropy in Queensland.

Maureen's steadfast commitment and generous support of the Institute for Glycomics are truly admirable. Over the last seven years, Maureen's philanthropic endeavours have left an indelible mark on various fronts, including championing the Malaria Vaccine Project, fostering scholarship initiatives, empowering women in research through our Glycomics Circle initiative and providing vital general support.

Through her benevolent contributions, Maureen has played a pivotal role in advancing our pioneering research efforts, facilitating innovative solutions, and unearthing discoveries in the ongoing battle against globally impactful diseases. Her dedication to supporting scholarships has empowered budding scientists to pursue their aspirations and contribute meaningfully to the biomedical research landscape.





Official opening of Community Bank Paradise Point Flow Cytometry Facility

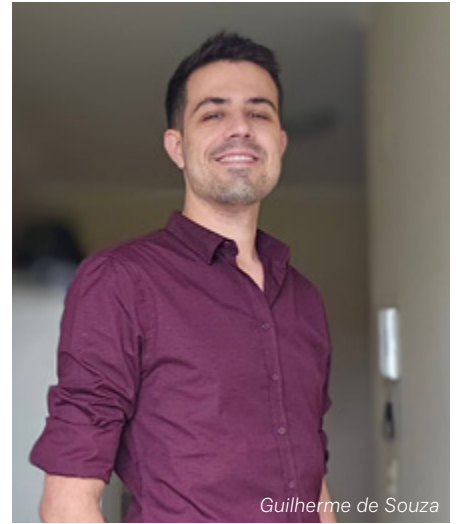
On Tuesday 3 October, the Institute celebrated the launch of the Community Bank Paradise Point Flow Cytometry Facility.

Community Bank Paradise Point, a long-term supporter of the Institute for Glycomics, provided philanthropic support towards the purchase of a new flow cytometry instrument.

Flow cytometry is a powerful tool in medical research, capable of analysing the characteristics of cells and other particles in a sample. This technology is particularly useful for studying cancer and infectious diseases, as it can quickly and accurately identify cell populations that are abnormal or diseased.

This new flow cytometry facility will become the central workhorse for the Institute's research teams across cancer and infectious diseases. The facility will enable researchers to analyse large numbers of cells quickly and accurately, providing valuable insights into the underlying causes of disease and potential new treatments. The Institute is confident that this new instrument will be a major asset for its research teams and will help to further advancements and discoveries.

Community Bank Paradise Point's philanthropic support of the Institute for Glycomics through the purchase of a new flow cytometry instrument is a sterling example of how community-based and focused organisations can make a global impact.



Guilherme de Souza



The Malaria Vaccine Project

Over the past 5 years, it is estimated there have been over 1 billion cases of malaria worldwide. Imagine by 2028 we have a game changing, proven vaccine, and that by 2033 it can be rolled out to the countries that need it most. For the past 10 years Griffith University, in partnership with Rotary, has been developing a vaccine candidate that could make this a reality.

Our team at the Institute for Glycomics is about to embark on a clinical trial for this game changing vaccine and the support of community partners such as Rotary have brought us to this point.

In the last decade Griffith University has secured transformational philanthropic investment, government backing and competitive grant funding to invest over \$20m in the accelerated research development and translational impact of this vaccine. Our work has been endorsed by leading global experts in this field as one of the most significant new vaccine candidates capable of addressing the alarming mortality rates from malaria each year. With support from our key partner Rotary and our community of philanthropic donors, Australia's National Health and Medical Research Council (NHMRC) and the Medical Research Future Fund (MRFF), our Phase I clinical trial has already attracted \$2.8m in confirmed support.

In 2023, the global grant target for the Postdoctoral Fellowship was reached following an incredible fundraising initiative involving Rotary clubs from all over Australia and overseas and from personal donations. Postdoctoral Scholar, Guilherme de Souza, hailing from Brazil was the recipient of this global grant. His expertise and prior involvement in malaria projects within his homeland, make him a valuable addition to Professor Michael Good and Associate Professor Danielle Staniscic's research team.

In a very special development in 2023, the Institute for Glycomics and Rotary were thrilled to announce The Honourable Anna Bligh AC became the inaugural National Ambassador for its Malaria Vaccine Project. Ms. Bligh has joined our team of passionate researchers and community members to bring us one step closer to testing our malaria vaccine candidate in areas where it is needed most and, hopefully, one step closer to a future free from the disease.



Bourne Foundation Nuclear Magnetic Resonance (NMR) Spectroscopy Facility Official Opening

We're excited to announce the launch of the Bourne Foundation Nuclear Magnetic Resonance (NMR) Facility, an institute core facility that has been rebuilt to house the world's latest NMR instrumentation with a significant donation from Bourne Foundation.

The Bourne Foundation Nuclear Magnetic Resonance (NMR) Spectroscopy Facility now houses a brand new 600MHz NMR Spectrometer with a QCI-F Cryoprobe, the first to be installed in Australia.

This spectrometer substantially increases the capacity for high throughput screening of samples and the QCI-F Cryoprobe has enhanced our capability in the emerging field of fluorine-19 NMR, which is an increasingly important drug discovery tool. The facility now houses three NMR spectrometers, making way for the Institute to explore new NMR applications in the health and medical space. With this exciting facility upgrade, research scientists will also have the ability to work with clinicians to obtain metabolomic profiles of blood, serum and urine samples for the purpose of biomarker discovery, early diagnostics, drug screening and numerous other medical applications.

"NMR Spectroscopy can provide extensive information about the structure, dynamic and chemical environment of atoms and molecules", says Associate Professor Thomas Haselhorst, Institute for Glycomics research leader and expert in NMR spectroscopy, structure guided drug design and medicinal chemistry. "We use NMR spectroscopy regularly to analyse the interaction of small ligands such as glycans with their target proteins, cells, and even intact virus particles, bacteria, or parasites. This technique is not only

vital for gaining a deeper understanding of these important interactions but also furnishes fundamental knowledge crucial to the development of ground-breaking anticancer and antiviral drugs.

Valued supporters of the Institute for Glycomics, Bourne Foundation, funded the purchase of the new instrument in memory of their founder, Mr Arthur Bourne, a hard-working entrepreneur with an engineering flair who was committed to playing his part in progressing medical discoveries and cures for the future of global health. He understood the necessity of investment in infrastructure to the advancement and progression of research.

"We see this capital expenditure as a vital piece of the research puzzle which will provide significant assistance in discoveries made at the Institute for years to come," confirmed Sid Catlin, Director, Bourne Foundation. "We are honoured to contribute and play our part in world-leading research."

The facility was officially opened by Professor Mark von Itzstein AO, Director, Institute for Glycomics, Mr Marcus Ward, Vice President (Advancement), Griffith University and Mr Sid Catlin, Director, Bourne Foundation. Official proceedings included a tour of the state-of-the-art facility.

"This facility is critical to the Institute's drug and vaccine success. The tremendous support from the Bourne Foundation will continue to propel our discoveries well into the future, contributing to global health for generations to come," said Professor Mark von Itzstein AO, Director, Institute for Glycomics.





Community engagement case study

The Hay Family's bright impact on melanoma research at Griffith University's Institute for Glycomics

Griffith University's Institute for Glycomics is not just a research facility housing world class infrastructure; it is home to world leading expertise, driven by the promise of contributing to a brighter future for all with a lab bench to patient bedside focus. This balance of research progress and instrumentation that deliver precision results, thrives on the support, partnership and advocacy of our community.

The tapestry of support from foundations, individuals, businesses and community groups who share our vision of advancing discoveries against some of the worlds' most devastating diseases, are tightly intertwined, strengthening and propelling our research forward. The Hay family are an example of how the Institute for Glycomics engages with its valued community members and builds lasting relationships for a unified cause to create maximum impact.

Peter and Margie Hay were first introduced to the Institute for Glycomics at the 2020 Women's Pink Golf Day, a highly anticipated event which forms part of the exciting social calendar in GO PINK month Breast Cancer Awareness partnership between Sanctuary Cove Golf and Country Club and the Institute for Glycomics This introduction was followed by a personal tour of the Institute with our Director, Professor Mark von Itzstein AO. The tour enabled Peter and Margie to confirm the alignment of the research teams' focus with the desires of the Hay Family to progress outcomes in cancer research. It resulted in support for the institute in a number of areas. This initial 3-year program support blossomed into a strong commitment across a number of

areas including the melanoma cell bank, a cancer research facility complementing cancer research in the Australian Cancer Research Foundation International Centre for Cancer Glycomics. This support from the Hay family exemplifies the powerful progress that can be achieved when an active community collaborates with a pioneering institution.

The Hay family's and other donors support has had a profound impact on the Institute's research initiatives. Their donations and commitment have enabled us to continue the fight against cancer through further understanding of cancer glycolanguage, the bolstering of our Melanoma Cellbank, and the continued support of top talent in our PhD students. Through their partnership, the Institute has been bolstered in strength, to push the boundaries of glycomics research, with a focus on cancer-based projects.

The story of the Hay family's involvement with the Griffith University Institute for Glycomics is a testament to the power of community engagement in scientific research. Their generosity has not only driven cancer glycomics research forward but have also strengthened the bonds between the Institute and its community. It serves as an example of how a shared vision can lead to transformative advancements and inspire others to become active participants in the journey of scientific discovery.

Our Major Supporters and Honorary Fellows

Major Supporters

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- Aston Milan
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- Rotary International District 9640 – District Conference 2018
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- Australian Cancer Research Foundation
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- Rotary Club of Engadine
- Rotary International District 9640 – Partner Project 2019-20
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- Rotary Club of Hornsby
- Rotarians Against Malaria – PNG (Rod Seddon)
- Sanctuary Cove Golf and Country Club
- Charles Wang Family
- Community Bank Paradise Point, Branch of Bendigo Bank
- Rotary Club of Mackay West
- Geoffrey Thomas
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- Reuben Pelerman Benevolent Foundation
- Rotary Club of Surfers Paradise
- Rotary Club of Gold Coast
- Bourne Foundation
- Australian Lions Childhood Cancer Research Foundation
- Hay Family Benevolent Fund
- Rotarians Against Malaria – Australia
- Rotary International District 9640 – District Conference 2018
- Herb Elliott AC MBE
- Rob Deshon
- Ged Williams
- Ray White Sanctuary Cove
- Voudouris Group
- Earbus Foundation of WA
- Ovarian Cancer Research Foundation
- Leducq Foundation

Honorary Fellows

- Roma Blair
- Greg Dillon
- Mary Roosevelt
- Cr Dawn Crichlow OAM
- Jenny Wong, DUniv
- Warren von Bibra & Sally von Bibra
- The Hon Peter Beattie AC
- John Penglis
- James Wadham
- Dennis Standfield
- Bernard Ponting
- Lex Bell OAM
- Emeritus Professor Graham Jones AM
- The Hon Sam Doumany
- Beverly McIlwain
- The Hon Leneen Forde AC
- Harry Triguboff AO, DUniv & Rhonda Triguboff
- Baslyn Beel
- Jennifer Bartels
- Bob Gordon
- Lesley Woodford-Carr
- Charles Wang
- Raymond James

Our community partners, supporters and donors play a crucial role in helping to support our cutting-edge research and advance our clinical trials.



**SELECTED
OUTSTANDING
PUBLICATIONS**



Ozberk et al.

A Glycolipidated-liposomal peptide vaccine confers long-term mucosal protection against Streptococcus pyogenes via IL-17, macrophages and neutrophils

Nat Commun 14: 5963. doi:10.1038/s41467-023-41410-7

As Streptococcus A cases continue to be prevalent in Queensland and internationally, a new nasal vaccine could provide long-term protection from the deadly bacteria.

Associate Professor Manisha Pandey, Professor Michael Good, and their team from Griffith University's Institute for Glycomics, are leading the development of a Strep A vaccine which is currently in Phase I clinical trials in Canada and quickly advancing to Phase II efficacy trials.

The team's new preclinical research, recently published in Nature Communications, shows an experimental liposome-based vaccine approach incorporating a conserved M-protein epitope from Strep A and an immunostimulatory glycolipid (3D(6-acyl) PHAD) administered via the nasal passage, can provide long-term mucosal protection against Strep A.

Lead author Dr Victoria Ozberk said studies have shown most pathogens enter or colonise via the soft tissue in the upper respiratory tract, which is essentially the highway to the rest of the body.

"This has the potential to be a world-first as there are currently no subunit vaccines that target the upper respiratory tract due to a lack of licenced immunostimulants suitable for human use," Dr Ozberk said.

"We demonstrated that a liposomal mucosal vaccination strategy can induce robust local protective immunity."

Associate Professor Pandey said the team found PHAD plays an augmenting role in inducing enduring humoral and cellular immunity, which was evident for at least one-year post-vaccination.

"The longevity of immune response is a critical hallmark of successful vaccination and therefore the findings from this study are highly significant," she said.

Professor Good said: "In the future, this vaccine platform could pave the way for other mucosal pathogens."

Group A Streptococcus is a global human pathogen that leads to a wide range of infections from illnesses such as mild pharyngitis and impetigo to invasive diseases such as toxic shock syndrome, necrotising fasciitis, and cellulitis.

Professor Mark von Itzstein AO, Director of the Institute for Glycomics, welcomed these research findings.

"This platform provides a real shot at developing a new direction for vaccine discovery against significant infectious pathogens that cause serious and life-threatening diseases," he said.

Immunity to Strep A takes several years to develop, and currently, there is no vaccine available.

Moreover, repeated infections can lead to the post-streptococcal sequelae of rheumatic fever and rheumatic heart disease, for which the Australian Indigenous population bears the highest disease burden globally.

Strep A causes 700 million human infections each year and there are more than 500,000 deaths globally.

The team has developed a Strep A vaccine which is currently being tested in a human clinical trial in Canada.



Everest-Dass *et al.*

Spontaneous metastasis xenograft models link CD44 isoform 4 to angiogenesis, hypoxia, EMT and mitochondria-related pathways in colorectal cancer

Mol Oncol: Online ahead of print. doi:10.1002/1878-0261.13535

The results from a study led by research scientists from Griffith University's Institute for Glycomics could offer a new therapeutic strategy for managing the spread of colorectal cancer.

Colorectal cancer is a type of cancer that affects the colon (large intestine) or rectum. The World Health Organization lists colorectal cancer as the second leading cause of cancer related deaths globally. Australia has one of the highest incidence rates in the world. Colorectal cancer is often diagnosed in the advanced stages when treatment options are limited.

The team, led by Dr Arun Everest-Dass, lead author on a paper published in *Molecular Oncology* journal have been investigating the impact of proteins on a specific cancer biomarker (CD44) in the metastatic progression of colorectal cancer.

"Hematogenous metastasis, where the cancer cells enter the blood and travel to new areas of the body, severely limits the survival of colorectal cancer patients" explains Dr Everest-Dass.

"Our study examines the roles and expressions of two specific isoforms of the CD44 biomarker; their correlation with patient outcomes and their relationships with key biological processes and features such as cell transformation and regulation during cancer progression, tumour formation and metastasis.

Our research sheds light on the differential roles of the biomarker isoforms in colorectal cancer. We are particularly interested in the contribution of one specific isoform towards metastasis and poor patient outcomes. The findings suggest that targeting the biomarker and isoform could offer novel therapeutic strategy for managing colorectal cancer metastasis."

Dr Everest-Dass is an expert in glycochemistry and glycobiology. He specialises in using advanced mass spectrometry equipment housed in the Australian Cancer Research Foundation International Centre for Cancer Glycomics, based at the Institute for Glycomics, to decipher the glyco-code that occurs in cancer. He says these findings will shape the future direction of the research.

"We will investigate the distinctive post-transformational modifications, including glycosylation, carried by the biomarker isoforms in colorectal cancer patients and explore their role in the metastatic progression of the cancer."

Distinguished Professor Mark von Itzstein AO, Foundation Director of the Institute for Glycomics and co-author on the paper is delighted with the outcomes of the study.

"Our cancer research endeavours are extensive as we strive to understand the complex biological processes that occur during cancer progression. This is the key to the discovery of novel diagnostics and treatment therapies for cancer patients."



**HIGHLIGHTS
FROM OUR
REMARKABLE
RESEARCH
LEADERS**

Principal Research Leaders



Professor Mark von Itzstein AO

Distinguished Professor von Itzstein and his group have research interests in: the chemical biology of carbohydrates and proteins that recognise them; enzymology; organic synthesis and reagent discovery; biocatalysis, including chemoenzymatic synthesis of biologically active molecules; structural biology; structure-informed drug and vaccine discovery; and computational biology. Major translational breakthroughs recently made by the group include the discovery of potent anti-parainfluenza and anti-influenza drug-like molecules and the synthesis of an anti-sepsis drug candidate, currently in human clinical trials.

In 2023, the von Itzstein group continued to use an interdisciplinary research approach towards the development of novel therapeutic agents, and investigation of the interactions of carbohydrates in both health and disease. Major research efforts of the group in the area of drug discovery – incorporating structure-informed design, synthetic chemistry, virology, and biology – are focused on viruses, in particular respiratory viruses, drug-resistant bacteria, and cancer.

Of particular note, are the on-going clinical trials of the anti-sepsis drug candidate STC3141 discovered by the von Itzstein group in collaboration the Parish group at the Australian National University. The industry partner China Grand Pharmaceutical and Healthcare Holdings is developing this drug candidate and announced in 2023 that STC3141 reached the appropriate endpoint in a Phase Ib clinical trial for safety, tolerability, and pharmacokinetics in Australia and Belgium, providing the foundation for further clinical studies. Phase II clinical trials for the treatment of sepsis (in China) were approved and commenced in late 2023.

Furthermore, in other areas of research the von Itzstein group filed two patents in antimicrobial drug candidate development.

Fundamental discovery research also continues to be a major interest of the von Itzstein group. As an exemplar, the von Itzstein group published in the journal *Inorganic Chemistry* (doi:10.1021/acs.inorgchem.3c01391), with Berners-Price and Farrell, a further study that explores metalloglycomics. In this study, NMR spectroscopy was used to investigate the interactions of the trinuclear platinum anticancer drug triplatin with sulfated and carboxylated disaccharides. These disaccharides are useful models of a longer-chain glycosaminoglycan (GAG) including the abundant GAG, heparan sulfate (HS).

In 2023, the von Itzstein group have made significant advances in the development of new and alternative antimicrobial therapies particularly targeting bacteria that have developed multidrug resistance profiles. To this end, the von Itzstein group continue to study a class of molecules known as ionophores that disrupt metal homeostasis and in 2023 the group have developed several new-highly active preclinical candidates that are now under further investigation.

Finally, Professor von Itzstein has been successful in jointly winning with Professor Armin Braun (Fraunhofer Institute for Experimental Toxicology and Medicine [ITEM], Hannover), a further multi-million dollar grant in support of a five-year continuation of the established *international Consortium for Anti-infective Research* (iCAIR). iCAIR is a German-Australian collaboration between the Fraunhofer ITEM and Griffith University's Institute for Glycomics that has a focus on solving specific respiratory infectious diseases.



Professor Michael Jennings

The Professor Michael Jennings research group focuses on understanding how carbohydrates influence key steps in infectious diseases and in cancer then using this information to find new strategies to diagnose, prevent and treat disease.

In late 2023 Professor Jennings was awarded a NHMRC level 3 Investigator grant entitled, "*Discovery and exploitation of pathogen-host glycointeractions to create new opportunities to prevent and treat infectious disease.*" This ~3 million dollar grant will support activities across all areas of Professor Jennings' research program (2024–2028 inc.).

The Jennings group, in collaboration with Dr Lucy Shewell, Dr Christopher Day and Professor Daniel Kolorich, lead a research program on cancer diagnosis. This project is based on a technology that we have developed to detect a cancer-specific sugar called Neu5Gc. We have previously demonstrated that this sugar can be detected in all stages of ovarian and breast cancer. In 2023 our team, in conjunction with other investigators, were awarded a \$444,000 grant from the Ovarian Cancer Research Foundation to further the development of ovarian cancer diagnostics.

In 2023 we also published a study in indicating that Neu5Gc biomarkers are elevated in blood from melanoma cases. The program also published a major review "*N-glycolylneuraminic acid as a carbohydrate cancer biomarker*" in *Translational Oncology* (doi.org/10.1016/j.tranon.2023.101643).

The Jennings group have a program on repurposing existing drugs to treat infectious diseases, with several patented technologies and a current program screening for new repurposing opportunities.

In 2023 we published a key human study confirming the bioavailability of an oral epilepsy drug, carbamazepine (Tegretol) in mucosal secretions (Repurposing Carbamazepine To Treat Gonococcal Infection in Women: Oral Delivery for Control of Epilepsy Generates Therapeutically Effective Levels in Vaginal Secretions. (*Antimicrob Agents Chemother* 67: e00968-22. doi:10.1128/aac.00968-22). The study has enabled a clinical trial to test the efficacy of this drug to treat multi drug resistant gonococcal infections, which will begin in 2024.



Professor Michael Good AO

Laboratory of Vaccines for the Developing World

There has been significant progress in our clinical trials for three major vaccines. Our 'whole parasite' malaria vaccine passed a major hurdle with the completion of the formal toxicological evaluation of the vaccine by an independent clinical research organisation. The vaccine, containing purified cultured *Plasmodium falciparum* parasites, is designed to significantly minimise the morbidity and mortality associated with malaria – a disease which kills over 600,000 young children each year. The technology that we developed, and which underpins the design of this vaccine, is applicable to other vaccines and this led us to a novel design for a Babesia vaccine. Babesiosis is a tick-borne disease, and while it does affect humans, in Australia it is predominantly a disease of cattle. Globally ~400 million cows are at risk of babesiosis. With Australian Research Council funding, we are embarking on a trial of our whole parasite vaccine, which will be able to be freeze-dried to a powder, facilitating easy uptake by farmers in remote parts of the country.

The Strep A/rheumatic heart disease vaccine that we developed is currently in Phase I trials in Canada. The Heart Foundation, the Snow Foundation, the Lowitja Institute, the Li Ka Shing Institute (Edmonton), and now the Leducq Foundation (Boston) are major supporters of this trial. Our preliminary data show that the vaccine is inducing very good antibody levels in vaccinated volunteers, and we are now planning for follow-up trials in Australia to test vaccine efficacy. Success with this vaccine will reduce the suffering of millions of children globally whose Strep A infections lead to rheumatic fever and rheumatic heart disease. Australia's Aboriginal and Torres Strait Islander populations suffer the

highest documented rate of rheumatic heart disease in the world. The vaccine will also prevent the serious invasive streptococcal disease (also known as necrotising fasciitis or 'flesh-eating disease'). The incidence of this disease has more than trebled over the last 10 years. It has a very high mortality (up to 25%) and sadly can lead to loss of limbs in those who survive. It occurs across the age spectrum. Our vaccine work was presented internationally at the World Congress on Rheumatic Heart Disease in Abu Dhabi and at the Australian Society of Immunology in New Zealand.

I would like to acknowledge the hard work and dedication of all my laboratory staff and students, and the wonderful leadership of the malaria and Strep A Teams by Assoc. Professors Danielle Stanisc and Manisha Pandey, respectively. I also thank our commercial team (Dr Chris Davis, and Eloise Keeffe), the hard-working admin group at Glycomics and the wonderful members of the Rotary Malaria Vaccine Committee, superbly led by Mrs Sandra Doumany OAM. Rotary have raised and leveraged over \$2.8M, enabling us to proceed with the malaria vaccine trial.

I was delighted that Dr Victoria Ozberk (a graduate of our lab) was promoted to Early Career Research Leader and Ms Winter Okoth was awarded her PhD for her wonderful work on our malaria vaccine. I was very honoured to receive the Dr John Raftos Medal and \$50,000 award from the National Foundation for Medical Research and Innovation (NFMRI). NFMRI has supported both our malaria and Strep A vaccine programs at critical times in development. The award is being matched by the Institute for Glycomics and will be used to upgrade our immunological technology within the lab.



Professor Carolyn Mountford

Principal Research Leader Professor Carolyn Mountford MSc DPhil (University of Oxford) MS (Harvard University) was awarded full Professor of Radiology at Harvard Medical School in 2011. She and her team are world leaders in the development of magnetic resonance (MR) technology to address unmet clinical needs. Her translational research includes mental health, pain and women's health in the cancer field centres on MR technology.

The multidisciplinary team includes surgeons Professors Malycha, Bennett, Perrin and Wood; Radiologists Professors Santamaria, Jeavons, Wong, Watkins and Gustafson; Mental health specialists Professors Crompton and Young; and bioinformaticians Professor Irvine and Darren Lukas.

The Mountford research team uses clinical 3T scanners to monitor the effect of disease, pain and cancers with particular interest on the control and role of the human glycome. They have assigned seven fucosylated glycans in the human brain, which are affected differently by chronic pain, PTSD, and blast exposure. These Fuc- α (1-2) glycans have been shown in animal models by a Caltech team to be implicated in the mechanisms underlying neuronal development, learning and memory, regulation of the nervous system development and neuronal processes.

In a study funded by USA CTTSO, our team discovered that 22 neurochemicals were up-regulated in the female PTSD cohort and only 7 in the male cohort compared to healthy age gender-matched controls. Both genders with PTSD recorded increased L-isoleucine and lysine (20-30%) linked to learning ability, and cognition; glycerol-phosphocholine and phosphoryl choline (8 to 19%), linked to memory retrieval and intraneuronal signal trans-duction. The fucose- α (1-2) glycans, were affected differently according to gender. In men the fucose- α (1-2) glycan "Fuc 6" (F2: 4.44, F1: 1.37 ppm) increased by 42%. Women recorded increases in fucose- α (1-2) glycans "Fuc 3") 16%; "Fuc 5" 30%; a fucose- α (1-6) linkage 28%; and substrates α -L-fucose and β -L-fucose

by 37% and 46%. Women also recorded increased glutathione cysteine moiety; phenylalanine; homo-carnosine-GABA. GABA functions to reduce neuronal excitability by inhibiting nerve transmission. Glutathione redox imbalance is associated with neurodegeneration and protection and synaptic excitability. Phenylalanine is associated with depression.

The high risk breast program has reached important conclusions following a program that commenced in 2004 and the results of a longitudinal study that commenced in Newcastle in 2014 and continued in Brisbane, Adelaide and Barcelona. The data shows that in an apparently healthy breast, as determined by current imaging modalities, the MR spectroscopic evaluation of the same breast can:

- Independently determine breast density and breast cancer risk. This paper was awarded the front cover on JMRI, the Editorial and was in the top 10% of papers.
- Distinguish that breast tissue, normal by conventional imaging, has altered tissue chemistry consistent with "switched on states", in healthy tissue of tumour bearing and some at risk patients.
- From the ongoing longitudinal study we show that the risk of a cancer developing can be predicted early as 6 years prior.

The "Data Recognition" software developed to improve spectral quality is used to automatically evaluate each patient including those with trauma or at high risk for breast cancer. These recent developments in post processing of data off the scanner has made available more fucosylated glycans and their substrates for assignment with A/Prof. Haselhorst.

Professor Mountford and her team have been a worldwide development site for Siemens since 1999. Glycomics has a research agreement with the company DatChem of which Mountford and Malycha are Founders. DatChem is a "Company in Residence at Griffith" providing a new and exciting model for Australian commercialisation. It is anticipated that the breast prediction program will be tested at independent sites in 2025 on Siemens scanners.



Professor Nicolle Packer

Professor Nicolle Packer now has a 0.1 FTE position at the Institute for Glycomics and continues to work primarily with Professor Daniel Kolarich and Dr Arun Everest-Dass and their teams.

Prof. Packer's and the Institute's previous collaboration with Dr Christina Bursill (SAHMRI Adelaide) in the ARC Centre for Nanoscale BioPhotonics (CNBP) has again resulted in new funding of an ARC Ideas 4 year grant to further investigate "*Inhibition of Asialoglycoprotein Receptor 1: a novel strategy for atherosclerosis prevention*" in which she is a Chief Investigator (CIC) and Prof. Daniel Kolarich and Dr Arun Everest-Dass from the Institute for Glycomics as Associate Investigators. This new funding of \$1,184,728 is headed by Dr Bursill as CIA at the University of Adelaide with a 3 year postdoctoral position created at the Institute for Glycomics from 2025. This will complement the continuing funding from the 2022 Medical Research Future Fund Cardiovascular Health Mission (MRFF) scheme in which Prof. Packer and Dr Arun Everest-Dass are Chief Investigators (CIC and CIE respectively) on a project entitled "*The Asialoglycoprotein Receptor 1 (ASGR1): a novel target for atherosclerosis*". These two grants will ensure good progress will be made on the role and targeting of this protein interaction with glycans in cardiac disease.

As an elected board member of the newly formed Australian Glycoscience Society, Packer chaired the society's session on Glycobiology Down Under at the 2023 Annual Meeting of the US Society for Glycobiology held at Hawaii in November 2023. This session was intended to showcase Australian glycoscience research and foster international collaborative opportunities and had talks and posters from glycoscientists at all levels from around Australia.

Professor Packer was an invited speaker representing the Institute for Glycomics at the Gordon Glycobiology Research Conference on Biological Roles of Glycans as Major Building Blocks of Life in March 2023 in Ventura, California where she presented "*Brain Glycosylation: So Much to Still Learn!*" highlighting the lack of knowledge on the role of glycans in brain function and disease. She also gave a plenary lecture at the Omics Satellite of the International Peptide Meeting in Brisbane in October where she described the crucial role of specific glycans on the activity of an immunopeptide.

Packer was Chair of the Biology/Disease Human Proteome Project in 2023 and deputy Chair of the Human Glycoproteomics Initiative of this international project. As part of this role in integrating the analytical sciences into biology she sat on the Early Career Researcher panel at the HUMAN Proteomics Organisation (HUPO) Conference in Busan, Korea and gave a role model example summary talk on her career.



Professor Kate Seib

Professor Kate Seib's research group focuses on drug and vaccine development for infectious diseases including *Neisseria gonorrhoeae* and *Neisseria meningitidis*. The sexually transmitted infection gonorrhoea is a growing global health concern due to increasing antimicrobial resistance. There are more than 82 million cases of gonorrhoea each year, and if left untreated infection can lead to adverse pregnancy outcomes and infertility.

The Seib group and their collaborators are characterising new vaccine and drug targets for gonorrhoea. They are also running two clinical trials across seven study sites in Australia to evaluate whether the 4CMenB vaccine that is licenced to prevent invasive disease caused by *Neisseria meningitidis* is able to provide cross-protection against the closely related bacterium *N. gonorrhoeae*. Research in the Seib lab is performed by a highly talented team including: postdoctoral researchers Drs Evgeny Semchenko, Sherry Eskandari, Thilini Padeniya, Vasilli Kasimov, Luke Blakeway, and Alice Ascari; PhD students Xiaofan Chen, Valentin Slesarenko, and Dr Caroline Thng; Masters student Samantha Pratt; and Honours student Tristan Mendoza.

Highlights for the Seib group in 2023 include:

Ongoing work with Professor Michael Jennings and our industry partner LimmaTech Biologics to develop a gonorrhoea vaccine.

Completion of recruitment for the GoGoVax clinical trial, and completion of 12-month follow up visits for participants in the MenGO clinical trial, which are both evaluating 4CMenB vaccine protection against gonorrhoea. The GoGoVax and MenGO trials are due for completion in 2024 and 2025, respectively.

Professor Seib and members of the group presented their data at several conferences including the 23rd International Pathogenic *Neisseria* Conference in Boston USA; the WHO mRNA Technology Transfer Programme Meeting in Cape Town South Africa; the STI & HIV 2023 World Congress in Chicago USA; 2023 Annual Meeting of the Society for Glycobiology in Hawaii USA; the QLD Vaccine Symposium 2023, the Australian Society for Microbiology 2023 conference; the New Zealand Sexual Health Society (NZSHS) 2023 conference; and the Australia and New Zealand Society for Extracellular Vesicles Conference 2023.

Research Leaders



Professor Johnson Mak

Professor Johnson Mak and his group have research interests in assembly of entry and assembly of HIV. With a goal to fill the knowledge gaps in these areas, and to explore the translational potential of their findings, they tackle some of the most critical issues in HIV, including: (i) establishing an efficacious HIV vaccine; (ii) developing novel antivirals; and (iii) exploring practical preventive options for women. The team utilises lessons learnt in HIV biology toward SARS-CoV-2 research in attempt to fast pace both preventive and treatment options for our community.

In 2023, the Mak lab said farewell to Ms Sarah Andersen (née Blanchard) who has commenced her medical doctor training at Griffith University (and performs part time research work with Prof. Mark von Itzstein).

The Mak lab hosted Dr Jo Kit-Man Chan for a short stint for molecular biology trainings.

The Mak lab welcomed Dr Sheethal Reghu and Dr Abdulhakim (Ablikim) Bake to work on HIV biology that are funded by Australian NHMRC Ideas grant and US NIH R21 grant. Prior to joining the Mak lab in Australia, Dr Reghu completed her MSc in Nanyang Technological University (Singapore) and PhD in Japan Advanced Institute of Science and Technology (Japan) in Nano-Engineered Bacteria that resulted in multiple high impact publications and first author papers in journals, including *NanoToday* (2x), *Nano Letters*, *Biomaterials*, *Nature Communications* (2x), *ACS Central Science*, and *Angewandte Chemie*.

Dr Bake has a PhD in Physics from University of Wollongong with expertise in electron microscopy. Dr Bake has a total of 24 publications from his MSc and PhD, including first author publication in *Nature Communications*. Dr Bake is also a named inventor of two separate patents.

In collaboration with Prof. Alan Liew at Griffith Institute for Integrated and Intelligent Systems, the Mak lab welcomed Dr Shruti Phutke to utilise artificial intelligence to delineate relationship between cellular and virological components using fluorescent imaging. Some of Dr Phutke credentials include high impact papers in *IEEE Transactions on Image Processing* and *Pattern Recognition*.

In 2023, Dr de Villiers (née Spillings) described her novel strategies to quantify glycan-based interaction using viruses as model system, and these works were published in *STAR Protocols*.

The Mak lab hosted Mr Thibaut Flipo from one of the top engineering schools in France (Ecole Nationale Supérieure de Chimie de Montpellier) to undertake a 4-month internship at Griffith University to work on viral protein trafficking and virological synapses.

In collaboration with our French colleagues (Dr C Favard and Dr Muriaux), PhD student Mr Bremaud and Dr Mak contributed to a research paper in *Nature Communications* describing how HIV 're-model' the cytoskeleton network at the edge of the cell (known as cortical actin) to enable HIV particle to assemble and release.

In *Nature Methods*, Dr Mak commented on how a new RNA analyses approach will reveal important biological insight in RNA structures.



Professor Victoria Korolik

Victoria Korolik is a Professor of Microbiology at the School of Medical Science and she teaches Microbiology in the second year of many Health degrees. Her research resides within the Institute for Glycomics and her group is currently focused on studying the role of bacterial movement in human disease and interactions of microbes with their host.

The Korolik group is currently focused on studying the role of bacterial chemotaxis in pathogenicity and bacteria-host interactions; specifically, on deciphering ligand binding specificities of transmembrane chemosensory proteins of *Campylobacter jejuni*, *Campylobacter fetus* and *Helicobacter pylori*.

Recent breakthroughs of the Korolik group are highlighted by the discovery of a novel class of bacterial chemosensors with broad ligand specificities that may be related to sensing of the host molecules, and thus, may play a role in host-bacterial interactions.

The group is currently developing a new research area focused on biofilm formation and its role in disease transmission for campylobacters and vibrios, including *Vibrio cholerae*. Two new areas of research are being established in collaboration with University of California, involving glycan-binding proteins and host-bacterial interaction of *Vibrio cholerae*. The group published significant refereed papers in 2023.



Professor Daniel Kolarich

The aim of research efforts in the Kolarich Group is to understand the cell-level carbohydrate language; the glyco-code, in health and disease. Deciphering the glyco-code enables the advancement and translation of this knowledge into novel discoveries that lead to the development of novel diagnostics and therapies. For this purpose, major efforts are being undertaken in the development and validation of novel, out-of-the-box technologies and methodologies that make the glyco-code accessible and interpretable, so that the role of the glyco-code and its relevance in cell function, health and disease pathogenesis, can be uncovered.

The Kolarich group collaborates with multiple national and international partners to decipher the glyco-code in cancer, immunotherapy and infectious diseases but has been also leading the area of phyloglycomics; the science of understanding the evolutionary development of glycosylation across the different species. This knowledge will help us to better understand, for example, how different viruses can cross species borders and become zoonotic pathogens that jump from animals to e.g. humans.

2023 saw the welcome of several new group members: Dr. Merrina Anugraham and Dr. Alessandra Tozzi joined the team as post-doctoral fellows. Some fellow Master students were awarded their Master in Medical Research and continued their scientific journey with us and commenced their PhD adventure. Two HDR-candidates were successful in finishing their PhD and while we miss them, we wish them the best for their exciting future careers.

Other highlights include:

- We were successful in securing over \$812,000 in funding from the ARC for a Discovery Grant project that will, together with our partners at Australian Red Cross Lifeblood, shed new light onto the role glycosylation plays in erythropoiesis and how this knowledge can be used to make the *ex vivo* production of red blood cells viable. This exciting project is a collaborative effort between Institute for Glycomics researchers Kolarich, Dirr and Malde, together with Dr. Griffiths from the Australian Red Cross Lifeblood laboratories in Brisbane.
- We were excited to finally install and commission the ARC-LIEF supported high throughput glycomics infrastructure. This new system based on a world-leading capillary-gel electrophoresis (CGE) laser induced fluorescence (LIF) technology allows the routine analysis of 1000 samples a day, the first of its kind in Australia.
- Members of the Kolarich group were able to present their research at a number of national and international

conferences, such as the Glyco26 in Taiwan and the Society for Glycobiology meeting 2023 that was organised in Hawaii. The Institute for Glycomics, as well as many members of the Australian Glycoscience Society (AGS), also supported in part by the AGS, were able to attend these conferences to promote Australian and Griffith University glycoscience achievements, establish new collaborations and showcase Australian Research.

- As every year post the COVID-induced travel bans, we again welcomed visiting students from Europe as well as new Master students that are doing exciting work deciphering the glyco-code in blood products and stem cells, across the borders in evolution and cancer.
- Another exciting achievement of 2023 was that Daniel was granted a promotion to Professor.



Professor Joe Tiralongo

The current focus of Professor Joe Tiralongo's research group is studying the function and biosynthesis of carbohydrates in the context of fungal biology, including the effect of fungal polysaccharides on the human immune response and anti-fungal drug discovery, as well as the use of nano- and micro-technology to study complex glycobiology important in human health and disease.

In 2023, highlights from the Tiralongo group included the establishment of an exciting new collaboration with BioFab NZ, with planning for a co-supervised PhD project and additional engagement activities aligned with their fungal glycobiology program well underway. In addition, they welcomed a new PhD student who will be working on related aspects of this project. Following on from high-impact outputs in 2022, the Tiralongo group's growing reputation in the emerging field of glyconanotechnology was further enhanced by the awarding of a Griffith University Post-Doctoral Research Fellowship to a former Tiralongo Group PhD candidate, Dr Oren Cooper. Dr Cooper will be working on further developing novel glyconano-tools to study complex biological interactions in the Haselhorst and Day group.

Additional highlights in 2023, include Professor Tiralongo's attendance and presentation at a number of international conferences in Europe, including GlycoBioTech 2023 in Berlin, Germany and Bio-Europe Spring and Swiss Biotech Days in Basel, Switzerland, the attendance of the Marine BioConnect Conference in Adelaide, and the awarding of an Australian Centre for HIV and Hepatitis Virology Research (ACH4) grant in collaboration with the Johnson Group.



Associate Professor Lara Herrero

Associate Professor Lara Herrero's group utilises a One Health approach to make advancements in understanding and treating vector borne diseases, which combines field work, modelling and lab-based research. The group have made unique discoveries around pathogen dissemination/transmission in the arthropod vector and pathogenesis in the human host. Additionally, using primary human cells and mouse model of disease, they are assessing new glycotherapeutic treatment strategies as antivirals and targeted disease treatments for viral inflammatory disease.

In 2023, A/Prof. Herrero was awarded the Prime Minister's Prize for Science in the field of New Innovators. Considered to be Australia's premier science prizes with only five awarded each year, A/Prof. Herrero was awarded the Prize for her innovative strategies to translate a drug to market in under 10 years.

The Herrero Lab continued to make significant advances in science and public health with two collaborations with LifeBlood analysing the prevalence of key diseases of public health importance for Queensland. We welcomed undergraduate student Juniper Lethbridge who is working on understanding the patterns of legionella prevalence.

Post-doctoral researcher Dr Wesley Freppel was awarded a Griffith University Fellowship for his work in flavivirus research, which will see him dissect critical aspects of viral-induced pathology. A/Prof. Herrero and Dr Rudd, were part of a Griffith team lead by Prof. Marshall-Gradisnik awarded a 6M Stafford Fox grant to research Long-COVID. This grant will provide promising insights into the pathomechanisms of Long COVID.

Owing to her extensive microbiology and clinical expertise, A/Prof. Herrero was invited to be an Editor for the ASM journal 'Clinical Microbiology Reviews'. This prestigious journal ranks #3 out of 137 microbiology journals internationally.



Associate Professor Thomas Haselhorst

Associate Professor Thomas Haselhorst's group has a primary focus on structural glycoscience and using NMR spectroscopy to solve complex biological problems. In particular, how human pathogens (viruses, fungi and cancer) interact with glycan receptors expressed on cell surfaces. Recently, they established a Fragment-based Lead Discovery platform and *in silico* screening for efficient drug discovery.

In 2023, the Haselhorst group welcomed Joseph Parr as an Honours Student and Jonathan Ventura as a Capstone student. Joseph collaborated with Drs. Chris Day and Oren Cooper on isolating sulphated fucose-containing oligosaccharides (Fucoidans) from brown algae. Joseph received first-class Honours for his work and will commence his PhD studies within the Haselhorst group in 2024. Jonathan Ventura contributed to NMR spectroscopic structural characterisation of Setmelanotide, a peptide crucial for severe obesity treatment. Collaborating with Dr. Alpesh Malde, Jonathan conducted Molecular Dynamics (MD) simulations, successfully matching an NMR solution conformation with a low-energy MD structure, a vital step in peptide-based obesity drug design. Jacinta Martin, from Griffith University's School of Nursing and Midwifery, completed her Master's thesis in the Haselhorst group in 2023. Her work on *Campylobacter jejuni* adherence assays is being prepared for publication.

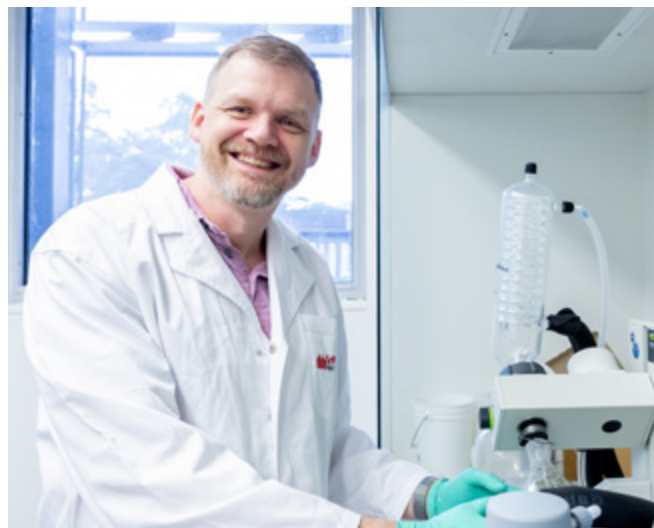
Dr Oren Cooper, a Postdoctoral Fellow in the Haselhorst group, experienced a remarkable year of achievements. Dr Cooper, only two years after completing his PhD, was awarded a Small Equipment Grant (SEG), a New Researcher Grant (NRG), and a prestigious Griffith University Postdoctoral Fellowship (GUPF) in 2023. These significant accomplishments will not only strengthen Dr Cooper's ongoing research into glycan-glycan interactions within the collaborative Haselhorst/Day group but also pave the way for his interest in the development of innovative glyconanoparticles using Carbon Dots. Dr Cooper was also promoted to 'Early Career Research Leader' a significant step in his early academic career.

In March 2023, Danielle Lee, during her PhD. final stages, presented her fungal research at Hannover Medical School in Germany and participated in the 'Fungal Update: Mycology 2023' conference in London, UK, where she received second prize for her poster presentation.

Additionally, she was invited as a panel member for the Glycomics Circle Meeting on 'Women in Science' in October 2023. At the Glycomics Student Forum, Danielle won the HDR student Oral Presentation Prize. In her research, Danielle achieved a significant milestone by developing a novel NMR-based enzyme assay to monitor the reaction of the UDP-galactose-pyranose mutase (Ugm) from *Aspergillus fumigatus*, an important target for antifungal drug development. Collaboration with Prof. Joe Tiralongo led to the establishment of a fungal host model using the greater wax moth *Galleria mellonella*, proving useful due to its cost-effectiveness and simplicity. In-vivo experiments with this model confirmed the efficacy and non-toxicity of three new lead compounds identified by Danielle, showcasing their potential for antifungal therapy.

The Haselhorst group published numerous articles in 2023. A highlight being an invited review in *Magnetic Resonance in Chemistry* that detailed the use of NMR spectroscopy to answer the complex questions of how viruses engage with and bind to receptor glycans (Haselhorst, *T. Mag. Res. Chem.*, 2023, DOI: 10.1002/mrc.5399). Another significant publication, in collaboration with Prof. Carolyn Mountford's team, showed that neurotransmission in blast-exposed artillery soldiers after live-fire training is significantly reduced (Tosh et al., *NMR Biomed.*, 2023, DOI: 10.1002/nbm.4934). The integration of non-invasive *in-vivo* Magnetic Resonance Spectroscopy techniques with *in-vitro* structural glycan NMR data offers unmatched insights into the secrets of the neuroglycome. Another highlight was a study in collaboration with the Medical School Hannover (Seegers et al., *Int J Mol Sci.*, 2023 24(3):1851. DOI: 10.3390/ijms24031851). Danielle Lee performed an extensive *in-silico* molecular screen against the deacetylase (Agd3) from *Aspergillus fumigatus* that mediates biofilm formation and enables virulence. Danielle Lee's *in-silico* screens identified that the known cancer drug *Imatinib*, sold under the brand names *Gleevec*, showed strong binding affinity to Agd3. Imatinib's potential to inhibit biofilm formation was later confirmed in *in-vitro* experiments. These findings open the door to the potential repurposing of Imatinib for antifungal applications, paving the way for future pharmaceutical developments aimed at combating fungal infections more effectively.

A/Prof. Haselhorst showcased the group's work globally, presenting at Glyco26 in Taipei and the GlycoNMR Summit in December 2023. A/Prof. Haselhorst was also invited to present a keynote address at the Australian Glycoscience Society session during the 2023 Annual Meeting SFG in Hawaii that A/Prof. Haselhorst could not attend.



Associate Professor Thomas Ve

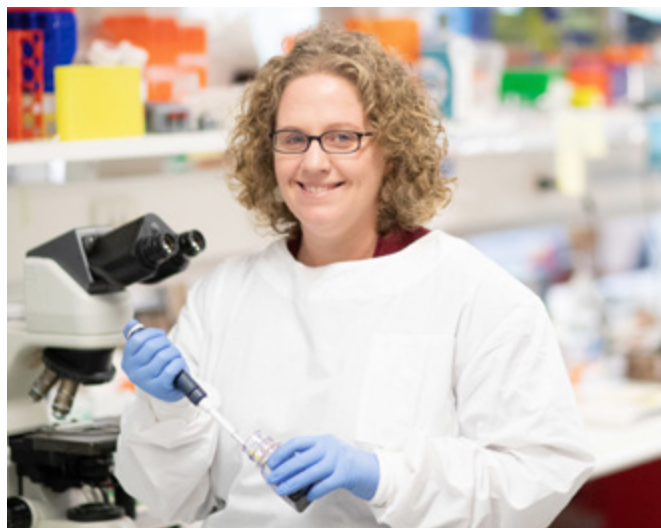
Associate Professor Thomas Ve's group is using an integrated approach combining structural techniques such as X-ray crystallography, NMR and cryo-EM with chemistry, biochemistry and cell-based functional assays. The major focus of the research involves characterising the biology and translational potential of a novel class of enzymes that breakdown the essential metabolite NAD⁺.

2023 was a productive year for the Ve group – together with collaborators from the US, the UK, the University of Queensland and the Institute for Glycomics, the group published new research and invited reviews in *Science Advances*, *The Neuroscientist*, *Current Opinion in Microbiology*, *Current Opinion in Plant Biology* and *Microbiology Spectrum*. The Ve group also continued their research with industry partner Eli Lilly & Co to understand the molecular mechanisms of orthosteric and allosteric SARM1 inhibition.

In 2023, Akansha Bhatt and Gause Miraj joined the group as PhD students and former PhD student Olivia Tan (co-supervised with Professor von Itzstein, Dr Guillon and Dr Dirr) graduated. Akansha's project is focused structural and functional characterisation of enzymes linked to neurodegeneration while Gause's project is focused on development of nucleoside and nucleotide analogues as molecular probes.

The group attended and presented research at Proteins Australia (Masic), the 26th Congress and General Assembly of the International Union of Crystallography (Ve and Mishra), the 23rd Meeting of the International Society of Magnetic Resonance (Shi) and CryOZ 2023 (Mishra). Dr Mishra won a prize for best poster at CryOZ 2023.

In 2023 Associate Professor Ve started his tenure as President of the Queensland Protein Group and he was chair for the annual Ross Smith Research Symposium.



Associate Professor Danielle Stanisc

In 2023, the malaria lab published a major publication in the prestigious journal, *mBio*, which describes the pre-clinical assessment of a whole parasite blood-stage malaria vaccine adjuvanted with CAF01 liposomes. This paper was a major component of the PhD thesis of Dr Winter Okoth, who was awarded her PhD in late 2023. This vaccine will be evaluated in a Phase I trial in 2024.

The formal toxicological study for the whole parasite blood-stage malaria vaccine adjuvanted with CAF01 liposomes was completed in 2023. This study was enabled by a substantial philanthropic donation from Mr Ray James. It demonstrated that the vaccine was safe and well tolerated, supporting the evaluation of this vaccine candidate in a Phase I trial. The Malaria Vaccine Project Committee, which was formed as a joint Rotary-Griffith University partnership, has continued to raise critical funding for the Malaria Vaccine Research Program including for the Phase I clinical trial and a fellowship which supports a new post-doctoral fellow in the malaria lab, Dr Guilherme de Souza.

Following on from the award of an ARC grant, preparations started in 2023 for a cattle trial to evaluate a whole parasite blood-stage babesiosis vaccine candidate. This trial will commence in 2024.

In 2023, together with investigators at Monash University, the Eijkman Institute for Molecular Biology and Ehime University, the Malaria Research Group was awarded an NHMRC Ideas grant. Together with investigators at Monash University, Latrobe University and WEHI they were also awarded an NHMRC E-Asia grant. These will enable an in depth assessment of the human immune response induced by the whole parasite malaria vaccine in clinical trials.

In 2023, the group bid farewell to Ms Priyanka Som (Research Assistant), Ms Heidi Plater (Research Assistant), Dr Reshma Nevagi (Research Fellow) and Dr Winter Okoth. They welcomed Mr Hamid Sadegh (Research Fellow), Dr Guilherme de Souza (Research Fellow), Mr Zac Doan (Research Assistant), Mr Soulat Farooq (Research Assistant) and Ms Skye van Esch (Masters student) who are all working on the Malaria Vaccine Program. They also welcomed Ms Arti Medhavy (Research Fellow) who is working on the Babesia Vaccine Program.



Associate Professor Milton Kiefel

Associate Professor Milton Kiefel's research group focuses on developing new chemistry methodology that facilitates the synthesis of molecules with potential applications in medicine and environmental sustainability.

In 2023, the Kiefel group continued to explore the development of antibacterial vaccine candidates through the exploitation of previously developed synthetic chemistry, as well as expanding the chemistry around butanolide synthesis which is a class of natural products with interesting anticancer activity. Much of the synthetic chemistry undertaken in the Kiefel group during 2023 focused on expanding the existing chemistry methodology to broaden our repertoire of available templates and target compounds. The Kiefel group continue to be interested in developing novel compounds with potential antibacterial activity, and in conjunction with colleagues at Griffith University, have expanded some of the work looking at natural products with interesting biological activity including those with potential use in treating Parkinson's disease.

Investigations into small molecules that can "switch" between two states when exposed to specific wavelengths of light culminated in a published paper and also the completion of the PhD by the student undertaking these exciting studies. This work showed for the first time that small molecules can be emissive in the near ultraviolet region of the spectrum, and further studies will investigate potential applications of these compounds, including their use as sensors with biological applications.



Associate Professor Manisha Pandey

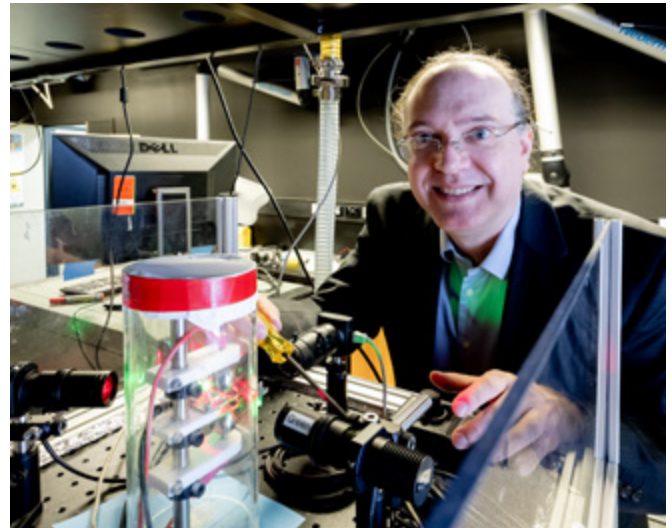
The research focus of the Pandey group, within the Laboratory for Vaccines for the developing World, centres on developing prophylactics and therapeutics for infectious diseases, with a primary emphasis on *Streptococcus pyogenes* (StrepA) and, more recently, COVID-19. These projects range from antigen discovery to the design of vaccine candidates, followed by their assessment in both *in vitro* and *in vivo* systems. The vaccine strategies predominantly rely on peptides and involve the utilisation of minimal epitopes to eliminate any risk of host-tissue cross-reactivity, a critical aspect in developing a safe vaccine. Additionally, the group takes a keen interest in investigating the correlates/mechanisms of adaptive immunity following infection and/or vaccination — a crucial understanding for designing effective vaccines and vaccination strategies.

In 2023, a major highlight for the team was the progression of the StrepA vaccine trial in Canada. The successful completion of stage 1 demonstrated the vaccine's safety and immunogenicity, providing a strong impetus for the team. Collaborating with the Li Ka Shing Institute for Virology at the University of Alberta, Canada, the group is now moving ahead with stage 2 of the trial. Following this, the planned phase 1b study, involving StrepA challenge of vaccinated individuals, is set to commence in Australia. The significant funding support from the Leducq Foundation was gratefully received, enabling progression towards a phase 2 study. Concurrently, the NHMRC Ideas grant funded collaborative COVID vaccine research with the University of Melbourne is progressing as planned. After identifying potent B-cell and T-cell vaccine antigens, the COMBAT team is gradually moving towards testing the combination vaccine in their murine model. Exploring a range of different adjuvants, they aim to identify the best combination for efficacy testing. This year, we also welcomed Dr. Aroon Supramaniam to the COMBAT team.

The team has disseminated their research through publications in high-impact factor, peer-reviewed journals such as *Nature Communications* and *mBio*. Collaborative research with Prof. N Ketheesan, University of New England, demonstrating the safety of StrepA vaccine antigens in the rat *Valvulitis* model was published in the journal *NPJ Vaccines*. Additionally, a research publication stemming from Jamie Lee Mills' PhD work has been accepted in *Frontiers in Immunology*. The group also actively represented their research in various national and international conferences, including the World Congress on

Rheumatic Heart Disease in Abu Dhabi and the Australian Society of Immunology in New Zealand. Mentoring efforts continued within the Pandey group, involving work experience/master's students. The group also welcomed Christie Short, who is enthusiastically working as a Research Assistant across a range of research projects.

The research achievements of the group were also recognized by various awards and promotions. Prof. Michael F Good, the laboratory head and mentor, was awarded the Dr. John Raftos AM Medal by the National Foundation of Medical Research and Innovation (NFMRI), and Dr. Victoria Ozberk was promoted to Early Career Research Leader.



Associate Professor Erik Streed

The Streed Biophysics group is a joint laboratory between the Institute for Glycomics and the Centre for Quantum Dynamics, which aims to foster the application of techniques from quantum physics to application in the life sciences and multi-disciplinary work more broadly. Associate Professor Streed was named to the Quantum Innovation Queensland advisory board as part of Queensland's Quantum and Advanced Technologies Strategy. Associate Professor Streed's contributions as a member of the working group for the strategy helped to shape key aspects of this strategy including proposed funding for a Quantum Bioinnovator program and application of quantum technologies into the 2032 Queensland Olympics.

Highlights for 2023 include the award of a Masters of Biotechnology to Anchal Rawat for her work on levitating ionised yeast cells as well as welcoming Honours student Adam Whyte to the optical readout of biofunctionalised microfabricated cantilevers project. Both joint projects with the Tiralongo group, and the latter effort engaging Dr. Oren Cooper.



Associate Professor Todd Houston

Associate Professor Todd Houston's group have: identified potent antitubercular compounds and novel sensors for cell-surface carbohydrates by synthesis of both bioactive and fluorescent molecules; discovered novel catalytic reactions through the study of boron interaction with carbohydrates; and discovered new immune modulating molecules, through the development of unique drug delivery systems.

In early 2023, Dr. Peter Sunde-Brown was awarded his PhD degree, marking the fifth straight year an HDR student has graduated from our group (4 PhD's, 1 Masters). I am very proud of all of these students for their perseverance through such challenging times. Peter has gone on to an industry-funded post-doctoral position at Keele University in the UK. Dr. Dylan Farr has published important work honing in on the molecular target of our most potent antitubercular compound and we are currently studying potential synergistic activity of our compounds with current TB drugs. In collaboration with Professor Victoria Korolik, we have also developed novel glycopolymers that appear to disrupt motility of the pathogen *Campylobacter jejuni* offering a potential treatment that does not induce drug resistance. We are looking forward to even bigger discoveries in 2024.



Dr Darren Grice

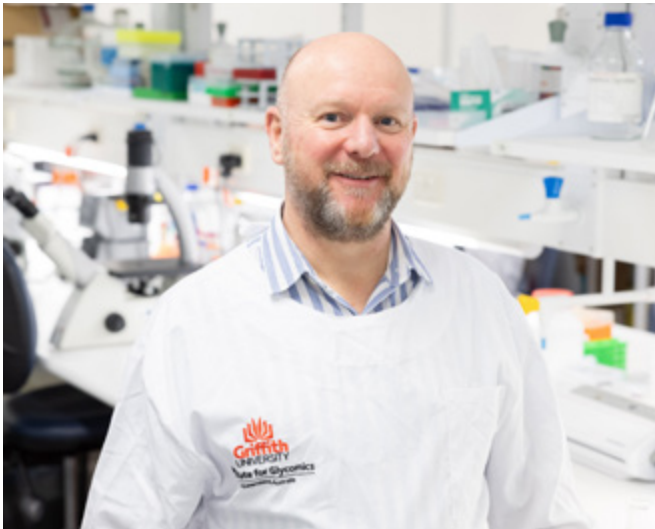
The Grice research group actively collaborates with other research groups within the Institute for Glycomics. The group has a multi-disciplinary organic chemistry focus with two main research themes (i) chemical structure determination and biological activity of naturally occurring compounds, principally carbohydrates from Gram-negative bacteria and fungi for therapeutic applications; and (ii) designing and synthesizing organic and carbohydrate-based molecules with potential as novel therapeutic agents.

In 2023 highlights have primarily been made on (i) Chemical structure determination and biological activity – Gram-negative bacteria and fungi:

Good progress was made in the research project investigating glycans (carbohydrates) present on the surface of Gram-negative bacteria. The project has direct relevance to understanding the mechanisms by which the host immune system recognises such bacteria and therefore progresses our understanding of this area for potential vaccine development. Kosala Ravikumaran's (PhD student) work was published in two research papers focused on novel surface glycan structures identified and new insights into the genetic machinery present within two bacteria in the *Moraxellaceae* family (*Journal of Carbohydrate Research*). An additional paper has also been submitted for publication, and two more for submission early 2024. This work is in collaboration with Dr Ian Peak and Adjunct Associate Professor Jenny Wilson.

Harvey Coates PhD Scholar Ayesha Zahid started her PhD in 2023 and made solid progress on the Earbus Foundation of WA philanthropically funded project developing our middle ear infection vaccine candidate. The work has a strong focus on Australian Indigenous children. Ayesha's review of the scientific literature on *otitis media* (middle ear infection) has now been published as a review paper in the research journal *Frontiers in Microbiology*. Project planning is currently being completed on selecting vaccine antigen candidates involved in middle ear infection for inclusion into our novel vaccine. This work is in collaboration with Dr Ian Peak and Adjunct Associate Professor Jenny Wilson.

PhD student Nirosha Dilrukshi started her PhD mid-2023 with focus on investigating specific carbohydrates from medicinal mushrooms that have indications of possessing immunostimulatory activity on the human immune system. Currently she is reviewing the scientific literature to prepare a review research paper focused on relevant prior work to her PhD research. The review is the basis for the research underway in 2024. This work is in collaboration with Professor Joe Tiralongo.



Dr Ian Peak

The Peak research group has a multi-disciplinary focus. The projects include (i) investigating genetic and biosynthetic mechanisms for how bacteria make sugar molecules on their surfaces (ii) investigating and developing new vaccines against childhood disease, particularly middle ear infections (iii) investigating how bacteria that are resident on our surfaces may be used in new ways to stop pathogenic bacteria, and (iv) investigating mammalian responses to molecules produced by bacteria.

(i) Genetics and synthesis of carbohydrates: Throughout the year, work continued in collaboration with Griffith researchers on solving the structures of carbohydrates from bacteria that live in the upper respiratory tract of humans and other mammals. These bacteria contribute to disease or may be involved in protecting against more virulent pathogens.

The Peak group contributes analysis and investigation of the genes involved in making these structures. Kosala Ravikumaran is a PhD candidate, co-supervised by Dr Grice, and A/Prof. Wilson (of Griffith's Health Group). Her work has uncovered the similarity and differences in carbohydrates produced by closely related bacteria from the upper respiratory tract of humans, and agriculturally important animals. She found that several produce sugars identical to those found on mammalian cells. Her work was accepted for publication in 2023, with two papers in the *Journal of Carbohydrate Research*. Kosala has also submitted another for publication, and at least one more is due for submission early 2024. Kosala's PhD thesis will be submitted and examined nearly 2024.

(ii) Childhood vaccine: With Dr Grice (Glycomics) and A/Prof. Wilson (Health Group), an outstanding international PhD candidate commenced in 2023, continuing the collaborative research towards a vaccine that targets diseases of the middle ear. Ayesha Zahid is the recipient of the Harvey Coates Scholarship, from generous support of Earbus Foundation of Western Australia. From her first year, Ayesha published a review of middle ear disease, and research models to investigate it.

(iii) Bacteria fighting bacteria: Dr Peak supervised a Master Pharm student in 2023, investigating interactions between bacteria that are usually non-harmful can interact and reduce the growth of *Pseudomonas*, which can cause severe disease in humans, and is often resistant to many antibiotic drugs. This early-stage work found a species that inhibits *Pseudomonas*, and future work will focus on characterising what molecules are being produced: this may lead to a new antimicrobial strategy against a significant pathogen.

(iv) Mammalian interactions with microbial molecules: Finn McMahon was a Master of Medical Research student, co-supervised by A/Prof. Gary Grant (Health Group), who submitted his thesis at end 2023. He continued Peak lab investigations on how bacterial molecules might be exploited in affecting disease outcomes. His work focused on effects on mammalian gut cells. His work extends the fundamental understanding of how bacteria and mammals talk to each other. Finn submitted his Master's thesis at end of 2023, and is aiming to continue studying, as a PhD candidate, within Glycomics.



Dr Chris Day

Dr Christopher Day's laboratory focuses on understanding host-pathogenic interactions reliant on carbohydrates and uses expertise in bioanalytical techniques to widely collaborate on a range of projects. Through this work, an engineered bacterial toxin subunit, SubB2M, is being translated as cancer diagnostic/treatment monitoring test.

In 2023, the Day lab was a part of the publication of four research outputs. These include the publication of preclinical work on a novel gonorrhoea treatment that has enabled the funding of a Gold Coast Health Collaborative Research Grant Scheme to trial the treatment in at risk patients.

A collaborative team including the Jennings, Day and Kolarich labs were awarded funding from the Bourne Foundation to further study the bacterial toxin SubB2M and its potential in improving prostate cancer diagnosis. This has funded a prospective clinical collection of a range of samples to allow diagnostic analysis beyond established blood tests.

Dr Oren Cooper a postdoctoral researcher for the ARC Discovery Project grant awarded to Dr Day and Associate Professor Haselhorst was awarded the Griffith University Postdoctoral Research Fellowship which will commence in 2024.

Dr Greg Tram who works with Dr Day and Professor Jennings on the NHMRC Toxin Ideas Grant was awarded a one year extension to their Griffith University Postdoctoral Research Fellowship to further extend the work on the bacterial toxins, cholesterol dependent cytolysins for 2024.



Dr John Attack

2023 saw the second PhD student from the Attack lab, Nusrat Nahar, graduate. Nusrat made several novel findings concerning gene regulation in the pig pathogen *Actinobacillus pleuropneumoniae*, which will have implications for developing new vaccines for this organism. This work was published in the prestigious journal *Nucleic Acids Research* in early 2023.

Nuala Ellaby graduate with a Masters of Medical Research (MMRes). Nuala's project concerned *Acinetobacter baumannii*. Nuala made some important findings into understanding how this organism interacts with the human host. We hope this will lead to the development of new treatments against this major bacterial pathogen.

Dr Zak Phillips made his return to the lab after graduating with his PhD in 2022. Dr Phillips is continuing with his work on gene expression and pathogenesis in *Streptococcus pneumoniae*, with an eye on developing new vaccines and treatments. Zak won the Institute for Glycomics Directors Medal in 2023, in recognition of an outstanding PhD thesis by a graduating PhD student. Zak published seven papers describing important advances in understanding gene expression in major bacterial pathogens of the human airway.

PhD student Ashley Fraser continued with excellent research progress. Ashley is characterising gene expression in non-typeable *Haemophilus influenzae*, a pathogen of the human airway. Ashley was elected to the Australian Society for Microbiology Queensland branch as a student rep, which gives her the chance to contribute to branch activities, and lead events aimed at microbiologists in Queensland. The lab also hosted several undergraduate students at various levels, all contributing to our work in non-typeable *Haemophilus influenzae* and *Streptococcus pneumoniae*.

The lab continued its study of major human pathogens with colleagues and collaborators across the globe, including two major publications in *Microbiology Spectrum*.

2023 saw John win an American Society for Microbiology Distinguished Service Award for his services to ASM journals. He continued his position as chair of the Australian Society for Microbiology Qld branch. In this role, John has organised and spearheaded several initiatives aimed at engaging colleagues in regional Qld, and improving chances for undergraduate and PhD students, and early career researchers, to attend scientific meetings and engage with the microbiology community in Australia. John was also invited to present the lab's work at the International Symposium on Recent Advances in Otitis Media, held in Milwaukee, USA.



Dr Santosh Rudrawar

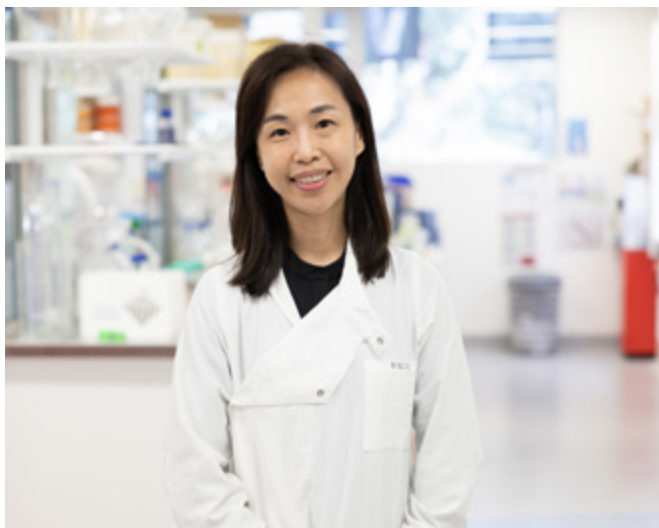
Dr Santosh Rudrawar's research group have research interest in use the power of organic medicinal chemistry to address problems of medical significance. The current research focus of the group is development of reagents for studying carbohydrate processing enzymes and nucleotide binding proteins to probe problems of medicinal and biological significance.

Essential mammalian enzyme O-GlcNAc transferase (OGT), regulates numerous cellular processes through the attachment of sugar residue to acceptor molecules – intracellular proteins through process called PTM. Several hundred proteins (~4000) involved in a wide range of cellular functions are modified with O-GlcNAc by single enzyme OGT. Unlike other PTM such as phosphorylation, where we have more than 500 protein kinases to modify similar set of proteins with a phosphate group. Aberrant OGT activity is a feature of several cancers. Taking inspiration from nature, the group used novel approach to produce first generation of inhibitors of the OGT enzyme – bisubstrate analogues. These studies were published in *Bioorganic Chemistry* and *ChemMedChem*. The group is now working on to develop these inhibitors as cell-permeable inhibitor probes which will allow studying role of this enzyme in cancer. These probes will have numerous applications in cancer diagnosis.

Interestingly, the post-translational modification by the addition of O-GlcNAc on proteins has protective effect against pathogenic processing of alpha-synuclein (Parkinson's disease) and tau (Alzheimer's disease) in neurodegenerative diseases. The research group also developed novel bimodal glycopeptides derived from truncated analogues of alpha-synuclein sequence and identified novel small molecules which significantly inhibited alpha-synuclein aggregation. These studies were published in *Bioorganic Chemistry*, *ChemistrySelect* and *ACS Chemical Neuroscience*.

Recently, group hosted two students from France to complete their internship projects: Charline Pouillaude (Ecole Nationale Supérieure de Chimie de Rennes) and Julie Hulot-Pate (Sigma Clermont).

Associate Research Leaders



Dr Freda Jen

In 2023, Dr. Freda Jen's research maintained a steadfast focus on developing drugs and vaccines for gonococcal disease. Collaborating with Dr. Ibrahim El-deeb and Prof. Jennifer Edwards, Dr. Jen was awarded a substantial \$1,383,053 Ideas Grant from the National Health and Medical Research Council (NHMRC) to combat multidrug-resistant gonorrhoea by disrupting bacterial metal homeostasis. At the same time, we continued our research in gonorrhoea vaccine development with LimmaTech, progressing towards creating a pioneering vaccine. Additionally, working with A/Prof. Milton Kiefel, we continued to target a bacterial glycan to create innovative vaccines for *Haemophilus influenzae* and *Neisseria gonorrhoeae*, supported by another NHMRC Ideas Grant. Dr. Jen presented this groundbreaking work at the 26th International Symposium on Glycoconjugates (Glyco26) conference in September.

PhD candidate Yuan Zhang achieved a significant milestone by obtaining her PhD for her thesis titled "*Characterization of Pili Phosphorylcholine Modification in Neisseria meningitidis*" and publishing her second first-author paper, "*Analysis of Bacterial Phosphorylcholine-Related Genes Reveals an Association between Type-Specific Biosynthesis Pathways and Biomolecules Targeted for Phosphorylcholine Modification,*" in *Microbiology Spectrum* (IF 7.6). Remarkably, our medical student Charlotte McHenry received the prestigious Glycomics Doctor of Medicine scholarship. Additionally, our Master of Pharmacy student Yan Yan (Victoria) Tang was honored with the esteemed 2024 Glycomics Student Scholarship.

Dr. Jen was promoted to research leader this year. Finally, Dr. Jen's research findings on the characterisation of pili-linked glycan structures in 100 meningococcal clinical strains from Africa were published in *ACS Infectious Diseases*.



Dr Evgeny Semchenko

Dr Semchenko (BSc, Hons, PhD, MASM) is an expert in the field of pathogenic *Neisseria*, an Associate Research Leader, and a member of the Seib research group. His key interest is investigating glycan-dependent host-pathogen interactions, which he uses to guide the discovery of new vaccine antigens and drug targets. Dr Semchenko's current research focuses on solving the urgent problem of multi-drug resistant gonorrhoea by developing new drugs, and vaccines to curb morbidity and spread of the infection.

Dr Semchenko's highlights for 2023 include:

Dr Semchenko has continued his appointment for the Australian Society for Microbiology National Scientific Advisory Committee (ASM NSAC) as an Early and Mid-Career Representative (EMCR) and organised an ASM Hour featuring prominent Australian early and mid-career researchers.

Dr Semchenko attended and presented his research at several conferences/meetings including his work on the discovery of new therapeutics to treat gonococcal disease at the International Pathogenic *Neisseria* Conference (IPNC, Boston, United States) and his NIH Development Research Project grant work on functional evaluation of serum samples to aid vaccine development at the Sexually Transmitted Infections Cooperative Research Centers (STI-CRC) Annual Meeting (USA).

Dr Semchenko together with Dr Jen, Professor Seib and Professor Jennings, continued their work on developing a suite of vaccine technologies for the prevention of *N. gonorrhoeae*. In 2022, the team had licenced and signed a co-development agreement with LimmaTech Biologics to develop and commercialise the gonococcal vaccine candidates.



Dr Penny Rudd

Dr Rudd's research revolves around vaccines and therapeutics to help alleviate/prevent viral infectious diseases such as Ross River virus (RRV) induced arthralgia and COVID-19. Her group focuses on RNA viruses with a particular interest in viruses from the *Togaviridae*, *Flaviviridae*, *Coronaviridae*, *Orthomyxoviridae* and *Paramyxoviridae* families. Dr Rudd focuses on understanding virus-host interactions and elucidating novel pathways and biomarkers that contribute to disease. By doing so, these important findings can be harnessed to develop new novel therapeutic targets that could ultimately reduce or eliminate the burden of disease.

In 2023, the Rudd group has continued working on a collaborative NHMRC funded project: COMBAT – A combination B- and T-cell epitope vaccine to futureproof COVID-19 vaccine in collaboration with A/Prof. Manisha Pandey. The year was spent doing many key experiments towards better understanding the drivers of immune protection following COVID-19 vaccination. Funded from 2022-2024, this project will also be a research area priority for 2024.

Other significant collaborations include the National Centre for Neuroimmunology and Emerging Diseases (NCNED), with Professor Sonya Marshall-Gradisnik's group. Dr Rudd is a co-investigator on a \$6.4 million grant from the Stafford Fox Medical Research Foundation led by Prof. Marshall-Gradisnik. This project will examine potential overlap between Long COVID and myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS).

Dr Rudd presented some of her most recent work at the 42nd annual American Society for Virology meeting held in Athens, Georgia, USA last July. Her talk described how digital spatial imaging can be used to characterise the immune influx that occurs during alphavirus infections.

Last year also saw the confirmation milestone of her PhD student, Yong Qian Koo. Yong is studying host factors involved in arboviral pathogenesis with a key interest in a particular factor called fibronectin-1 (FN-1). FN-1 plays an important role in the initiation of inflammation and the recruitment of immune cells.

Dr Rudd has also welcomed a new undergraduate student Hiro Irie who is co-supervised by Dr Grant Hansman. Hiro had a successful internship within the Rudd group, as part of his Advanced Studies Task. Hiro did so well, he even won a prize for the best poster presentation of his work. The Rudd/Hansman partnership will continue into 2024 with Hiro's return for another internship.



Dr Patrice Guillon

Dr Patrice Guillon's research is dedicated to exploring the glyco-interactions between respiratory viruses (such as hPIV, MuV, IAV, RSV, HMPV, and SARS-CoV-2) and their hosts. He recently started research on the prospective use of nanobodies as antiviral treatments against respiratory viruses.

Cells and viruses are covered with glycans which form the glycome of an organism. Each glycome is unique, dynamic, and highly diverse, with glycan specificities for each cell type, tissue, and species. Viruses can use these specific glycans to attach and enter host cells. Moreover, glycan binding proteins (lectins) expressed at the surface of specific host cell types can recognise and bind glycan motifs decorating viruses. This key-lock recognition mechanism may act in favour of the host by triggering an immune response against the virus, but also in favour of the virus by initiating infection. Studying these multiple levels of interaction can reveal key targets for antiviral drug design and vaccination strategies against respiratory viruses.

Nanobodies exhibit remarkable antiviral therapeutic potential attributed to their straightforward production, high stability in extreme environments, and bioengineering versatility. Nanobodies can be employed as building blocks to generate multivalent hetero-paratopic proteins capable of recognising distinctive viral proteins. Enhancing the valency of a single nanobody (multivalent homo-paratopic proteins) has been also shown to improve their efficacy and stability against respiratory virus infections.

Our group is particularly interested in discovering new antiviral agents based on sialic acid (glycan) and developing therapeutic nanobodies thanks to biomolecular engineering. To achieve that goal, techniques such as molecular biology, X-ray crystallography, nuclear magnetic resonance spectroscopy, and virological methods are routinely used. Our group also employs advanced cellular models (primary human airway epithelial cells differentiated at air-liquid interface) as a surrogate for human tissue to validate the action of inhibitors and study the biology of respiratory viruses in the context of the host.

In 2023, Dr Guillon's continued its collaboration with academic research groups through the iCAIR program and industry partner China Grand Medical to develop the first drug candidate against human parainfluenza virus. Dr Guillon's HDR student, Dr Olivia Tan, was awarded with PhD degree for her work on "Structure Determination of Human Parainfluenza Virus Type 1 Haemagglutinin-Neuraminidase and Antiviral Drug Design".

Early Career Research Leaders



Dr Mehfuz Zaman

Dr Mehfuz Zaman's team focuses on translational science encompassing drug/vaccine delivery, immunology and pre-clinical models with strong collaborative relationships, complementary skills and expertise that work synergistically in research projects to achieve successful outcomes.

The Zaman team had a productive 2023, with pre-clinical mucosal vaccine development studies moving forward, funded generously by the National Health and Medical Research Council (NHMRC).

Research highlights include:

Reporting on our glycolipidated liposomal vaccine platform for needle-free administration that enhance secretory immunoglobulin A (IgA)-mediated mucosal immunity for respiratory pathogens of interest in *Nature Communications*.

Research assistant Cassia Goulart has joined our team to lay the foundation for excellent progress in the lab.

Ella McCutcheon was awarded the Glycomics Doctor of Medicine Student Scholarship to undertake hands-on research experience in cutting-edge research projects within our team.



Dr Larissa Dirr

Dr Larissa Dirr is an NHMRC Early Career Research Fellow with expertise in structural biology, virology and glycoscience. The research program has a major translational focus on the discovery of new therapeutics against a range of human respiratory pathogens. Recent key achievements include the discovery and development of anti-parainfluenza drug-like molecules, broad-spectrum neuraminidase inhibitors, novel hit candidates against human metapneumovirus.

2023 was a great year, highlights include:

The ARC Discovery project grant entitled '*The role of protein glycosylation in erythropoiesis*' aims to understand how the sugar code of key-signalling proteins influences the development of red blood cells. This multidisciplinary grant is led by Institute for Glycomics researcher Professor Daniel Kolarich in collaboration with Dr Larissa Dirr, Dr Alpesh Malde and Dr Rebecca Griffiths from Australian Red Cross Lifeblood.

Former PhD student Olivia Tan Hui was awarded her PhD for the thesis entitled '*Structure determination of human parainfluenza virus type 1 haemagglutinin-neuraminidase and antiviral drug design*'.

Student Plabon Das is making strong advancements in his PhD research project that investigates the impact of virus infection on host cell glycosylation.

Publications highlights include a study joint publication with Dr Jana Führung from Medical School Hannover in the high-ranking journal *mBio*, about the opportunistic pathogen *Pseudomonas aeruginosa* which becomes increasingly difficult to treat. The team consisting of researchers from Medical School Hannover, Fraunhofer Institute for Toxicology and Experimental Medicine and Institute for Glycomics found a new allosteric site in a key enzyme of the bacteria that offers exciting opportunities for the design of new antibiotics.

A new student Charlotte Estampes has just started her PhD with Dr Patrice Guillon, Professor Mark von Itzstein and Dr Larissa Dirr. She will work on new therapy options for respiratory syncytial virus (RSV) that causes approximately 160,000 deaths worldwide each year.

Plenary, keynote and invited lectures in 2023

Date	Conference	Location	Research Scientist
Invited lectures			
15 July	Research related - EMBO course on PTMs	Denmark	Prof. Daniel Kolarich
25 August	Glyco26	Taiwan	Prof. Daniel Kolarich
19 October	Qld Immunology Networking Symposium	Australia	Dr Grant Hansman
6 November	Qld Vaccine Symposium	Australia	A/Prof. Danielle Stanisic
27 November	Australian Society for Parasitology Concepts in Parasitology course	Australia	A/Prof. Danielle Stanisic
Oral Presentations			
16 January	First AAU International Conference on Pharmacy and Biomedical Sciences	Abu Dhabi	Prof. Mark von Itzstein
7 March	Grand Pharma Annual Business Meeting	China	Prof. Mark von Itzstein
11 March	Rotary District 9640 Annual Conference	Australia	A/Prof. Danielle Stanisic
24 March	Page Medical UK	UK	Danielle Lee
3 April	World Vaccine Congress	USA	Dr Chris Davis
26 April	Asia-Pacific Vaccine and Immunotherapy Congress 2023	Australia	A/Prof. Manisha Pandey
7 May	Optica - Conference on Lasers and Optoelectronics (CLEO)	USA	A/Prof. Erik Streed
5 June	American Physical Society - Division of Atomic, Molecular, and Optical Physics Conference (DAMOP)	USA	A/Prof. Erik Streed
19 June	Communicable Diseases & Immunisation Conference 2023 (CDIC2023)	Australia	Dr Chris Davis
22 June	Fraunhofer seminar "Models of Lung Disease"	Germany	Prof. Mark von Itzstein
23 July	2023 STI and HIV World Congress	USA	Prof. Kate Seib
20 August	ISMAR 2023	Australia	Dr Yun Shi
20 August	15th Mosquito Control Association of Australian (MCAA) Conference	Australia	A/Prof. Lara Herrero
20 August	15th Mosquito Control Association of Australian (MCAA) Conference	Australia	Dr Wesley Freppel
27 August	Glyco26 (26th International Symposium on Glycoconjugates)	Taiwan	Dr Abarna Vidya Mohana Murugan
27 August	Glyco26 (26th International Symposium on Glycoconjugates)	Taiwan	A/Prof. Thomas Haselhorst
23 September	23rd International Pathogenic Neisseria Conference	USA	Dr Evgeny Semchenko
24 September	23rd International Pathogenic Neisseria Conference	USA	Prof. Kate Seib
24 September	23rd International Pathogenic Neisseria Conference	USA	Prof. Michael Jennings
19 October	Qld Immunology Networking Symposium	Australia	Dr Grant Hansman
1 November	World Congress on Rheumatic Heart Disease	UAE	A/Prof. Manisha Pandey
1 November	World Congress on Rheumatic Heart Disease	UAE	Dr Victoria Ozberk
5 November	Society for Glycobiology 2023	USA	Dr Larissa Heilig
5 November	2023 Meeting of the Society for Glycobiology	USA	Xiaofan (Amber) Chen
5 November	Society for Glycobiology Annual Conference	USA	Prof. Daniel Kolarich
4 December	International Conference on Quantum Energy / CSIRO	Australia	A/Prof. Erik Streed
4 December	Australian and New Zealand Society for Immunology ASI 2023	New Zealand	Dr Ailin Lepletier

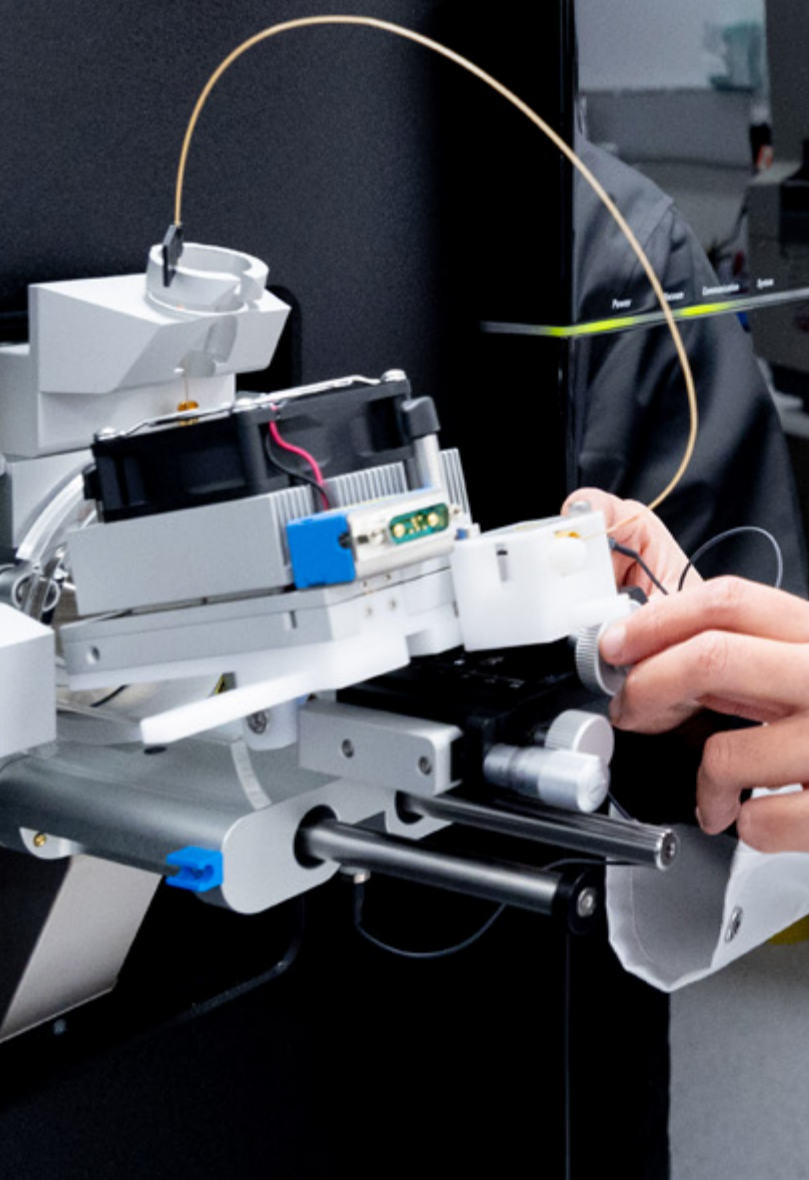
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Glycomics

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Our Institute boasts state-of-the-art facilities combined with some of the world's most outstanding researchers focused on biomedical research and glycomics.

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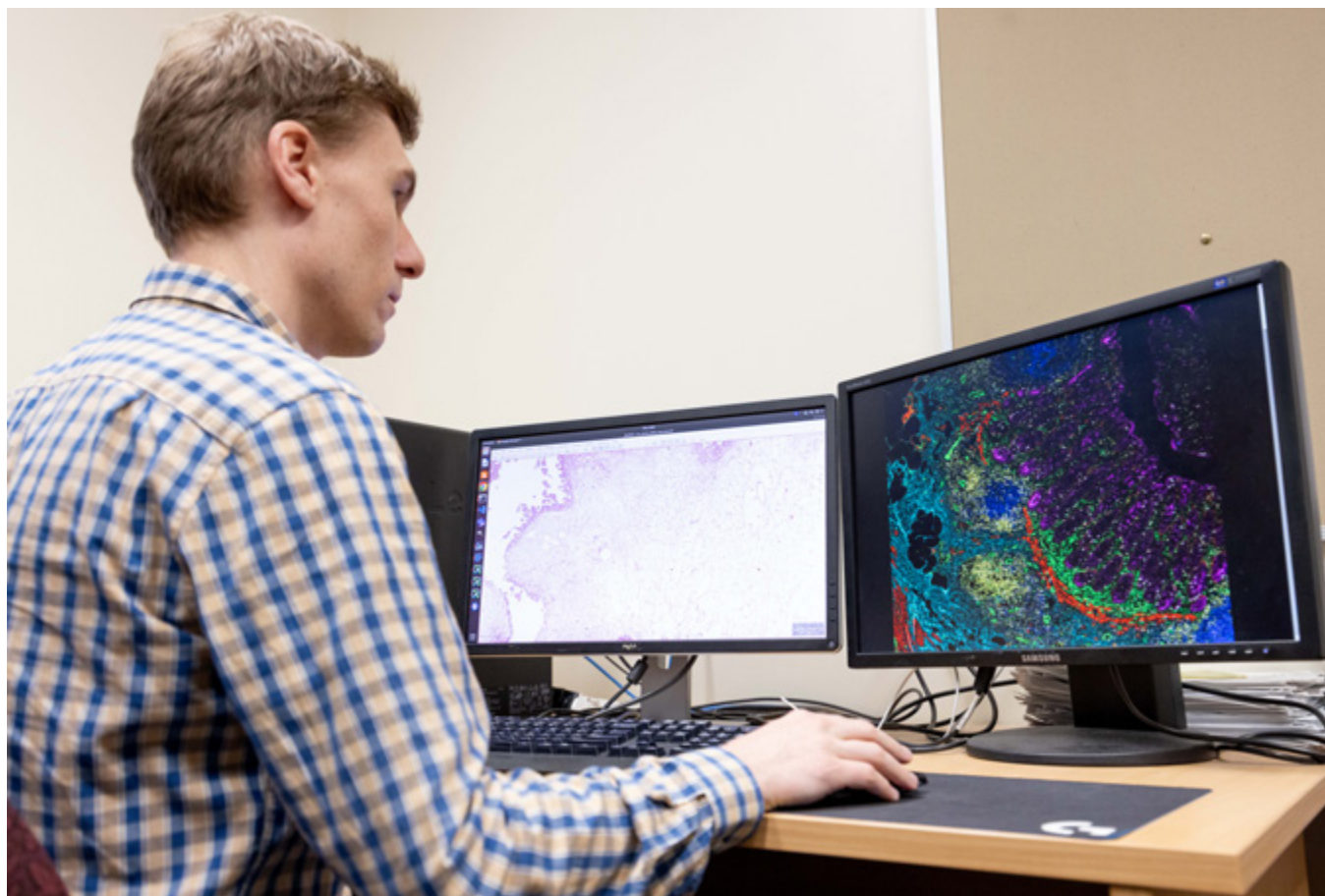


Griffith
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OUR FACILITIES



computational chemistry and visualisation equipment

The Institute for Glycomics' state-of-the-art infrastructure and equipment, coupled with our expert scientific personnel, facilitate our world-class research. Our impressive facilities, resources and services are also available to external research groups and industry.

The Institute for Glycomics has developed a multi-disciplinary translational approach for our equipment and facilities to allow us to cater for the diverse activities of our world-class researchers. Institute resources and facilities allows researchers to identify, synthesise, develop and evaluate novel diagnostics, drugs and vaccines.

Some of the impressive facilities within the Institute for Glycomics include:

Medicinal Chemistry Laboratories

The Institute houses over 700m² of medicinal chemistry laboratory space that allow our researchers to synthesise novel therapeutics. These laboratories are equipped to allow our researcher to perform and optimise complex chemical reactions safely. The facilities include high vacuum rotatory evaporators, purification and chromatography equipment and active-extraction fume cupboards with scrubbers. The medicinal chemistry laboratories also contain two dedicated hazard laboratories that house our microwave reactor and hydrogenator.

Computational Chemistry and Visualisation

The Institute for Glycomics houses state-of-the-art computational chemistry and visualisation equipment. This equipment allows researchers to perform biomolecular simulations to visualise and understand molecular interactions at an atomic level to better facilitate structure-based drug discovery in a range of therapeutic areas. The facility is supported by workstations with software for computing (eg YASARA, GROMOS) and visualisation (e.g., Chimera, PyMol). In addition, visualisation is supported by an exclusive 3D projector located within our lecture theatre to allow researchers to visualise and discuss computational models at a group level. Researchers can also access a 432-core high performance computing cluster with NVIDIA Tesla V100 GPUs. This allows researchers to conduct biomolecular simulations employing molecular dynamics, quantum mechanical and free energy calculations; refine and validate of X-ray and NMR structures; investigate drug – glycoprotein interactions structures and the virtual screening of compound libraries and guided lead optimisation.



Physical Containment Level 3 (PC3) Facility

Physical Containment Level 2 Laboratories

Once new and novel therapeutics have been synthesised and purified, the Institute for Glycomics has over 1350m² of Physical Containment Level 2 (PC2) laboratory facilities available for basic biology research, diagnostic and vaccine discovery and development, and the *in vitro* analysis and evaluation of lead compounds. These facilities are located across several floors of different buildings and host a range of equipment and facilities that allow our researchers to conduct experiments with a range of biological pathogens (bacteria, viruses, fungi and parasites) that cause significant morbidity and mortality in humans and/or animals. The Institute is also dual certified by the Office of the Gene Technology Regulator (PC2) and the Department of Agriculture, Water and the Environment (BC2) laboratory providing the capability to work with Biosecurity material. PC2 spaces are equipped with biological safety cabinets, incubators, centrifuges and other laboratory equipment with core areas suited to allow rapid reconfiguration for either bacterial, virus, fungi or parasite focused research.

Physical Containment Level 3 (PC3) Facility

The Institute for Glycomics houses the only Physical Containment Level 3 (PC3) facility at Griffith University. The 180m² plus facility is dual certified by the Office of the Gene Technology Regulator (PC3) and the Department of Agriculture, Water and the Environment (BC3) and capable of handling high risk pathogens. The facility consists of dedicated laboratory and animal facilities (in collaboration with the Bioscience Service Centre) that allows our researchers to safely evaluate new therapeutic drugs or potential vaccines for viruses and bacterial pathogens that currently pose a significant risk to humans or the environment. The multi-level facility is designed so that each laboratory space is individually HEPA filtered which can be operated independently of adjacent areas. Each space is equipped with Biological safety cabinets, incubators and associated laboratory equipment to allow rapid reconfiguration for either virus or bacterial pathogen research. This flexibly allows the researcher to respond to new and emerging pathogens, such as SARS-CoV-2. The Institute commenced a SARS-CoV-2 project in March to evaluate novel and repurposed drugs for COVID-19.



Community Bank Paradise Point Flow Cytometry Facility

Specialist Facilities

These core laboratories are supported by a range of specialised facilities and equipment. Co-localisation of these services enhances both basic and translational research outcomes through direct interaction of research and technical staff.

Specialist facilities within the Institute include:

- Bourne Foundation Nuclear Magnetic Resonance (NMR) Spectroscopy Facility
- Australian Cancer Research Foundation International Centre for Cancer Glycomics including the Advanced Mass Spectrometry Laboratory
- Glycobioanalytical Facility (Glycomics Array Facility and a Bioanalytical Suite)
- Community Bank Paradise Point Flow Cytometry Facility
- Separations Science Facility provides an analytical and preparative chromatography (HPLC/ FPLC) and mass spectrometry services
- ZymeBank provides enzymes essential for glycan synthesis in high quality and purity
- Protein X-ray crystallography
- Advanced microscopy and imaging
- Research facilities with capacity to handle radioactive isotopes
- Biophysics laser laboratory

Bourne Foundation Nuclear Magnetic Resonance (NMR) Spectroscopy Facility

The Bourne Foundation Nuclear Magnetic Resonance (NMR) Spectroscopy Facility was officially opened in October 2023 after a two-month refurbishment to expand the laboratory's capacity to accommodate three NMR spectrometers.

This facility proudly houses a brand-new Bruker 600MHz NMR Spectrometer with a QCI-F Cryoprobe, the first to be installed Australia, in addition to the upgrade of an existing spectrometer with a new metabolomics capability, thanks to a significant donation from the Bourne Foundation.

The new 600 Hz NMR spectrometer substantially increases the capacity for high throughput screening of samples and the QCI-F cryoprobe has enhanced our capability in the emerging field of fluorine-19 NMR, which is an increasingly important drug discovery tool. The research scientists at the Institute for Glycomics now are able to explore new NMR applications in the health and medical space as well as have the ability to work with clinicians to obtain metabolomic profiles of blood, serum and urine samples for the purpose of biomarker discovery, early diagnostics, drug screening and numerous other medical applications.




**2023 PUBLICATIONS
AND GRANTS**

2023 Publications

1. Agnew, H N, Atack, J M, Fernando, A R D, Waters, S N, van der Linden, M, Smith, E, Abell, A D, Brazel, E B, Paton, J C, and Trappetti, C. (2023) Uncovering the link between the *SpnIII* restriction modification system and LuxS in *Streptococcus pneumoniae* meningitis isolates. *Front Cell Infect Microbiol* **13**: 1177857. doi:10.3389/fcimb.2023.1177857
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The Institute's research is focused on the identification of new preventions, cures and diagnostic methods for infectious diseases, cancer and neurological disorders.

Grants and donations awarded in 2023

Grant name	Year funding commences	Project	Investigators	Total funds awarded \$AUD
NHMRC - Investigator Grant L3	2024	<i>Discovery and exploitation of glycointeractions to create new opportunities to diagnose, prevent and treat disease</i>	Jennings, Michael	2,954,040
NHMRC - Investigator Grant L2	2023	<i>A comprehensive vaccine-based strategy to combat gonorrhoea</i>	Seib, Kate	2,118,395
NHMRC - Ideas Grant	2024	<i>Combating multidrug-resistant gonorrhoea by breaking down bacterial metal homeostasis</i>	Jen, Freda; El-Deeb, Ibrahim	1,383,053
NHMRC - Ideas Grant	2023	<i>Unmask HIV latency through disruption of HIV synapses</i>	Mak, Johnson; Liew, Alan Wee-Chung	1,246,025
ARC Discovery Projects (including Fellowship)	2024	<i>The role of protein glycosylation in erythropoiesis</i>	Kolarich, Daniel; Dirr, Larissa; Malde, Alpesh	841,249
ARC Discovery Projects (including Fellowship)	2023	<i>Decoding Bacterial Epigenetic Regulation</i>	Seib, Kate	721,779
ARC Discovery Projects (including Fellowship)	2023	<i>A next-generation whole parasite bovine Babesia vaccine</i>	Stanisic, Danielle; Good, Michael	642,439
NIH US Research Grant	2023	<i>Dichotomy of HIV-Sugar with Vaginal Microbes</i>	Mak, Johnson	444,446
Dioraphte Foundation Proposal for Skin Neglected Tropical Diseases	2023	<i>Development of the first Scabies Rapid Antigen Test System for Point-of-Care</i>	Hansman, Grant Stuart	240,000
Rotary International District 9640 Ltd Global Grant 2342550 Malaria Postdoctoral Fellow	2023	<i>Global Grant Scholarship - Postdoctoral Fellow in the Malaria Vaccine Project (Dr Guilherme de Souza)</i>	Good, Michael; Stanisic, Danielle	140,000
NHMRC - Postgraduate Scholarships	2023	<i>Investigating Novel Prevention and Treatment Strategies for for Gonococcal Control (Dr Caroline Chun Mei Thng)</i>	Seib, Kate; Jennings, Michael	121,193
NHMRC Research Equipment Grant Support	2023	<i>NHMRC Standard Equipment Grant 2023</i>	Ve, Thomas	64,069
Australian Centre for HIV and Hepatitis Virology Research Grant	2023	<i>Magnetized Nano-Glycan-Traps to Dampen HIV Transmission</i>	De Villiers, Belinda; Cooper, Oren; Tiralongo, Joe; Mak, Johnson	50,000
Australian Centre for HIV and Hepatitis Virology Research Grant	2023	<i>Enhancing the Detection of Human T-Lymphotropic Virus Type 1 (HTLV-1) with State-of-the-Art Microfluidics</i>	Zhang, Jun; Nguyen, Nam-Trung; De Villiers, Belinda; Mak, Johnson	50,000
ConcR Pty Ltd Industry Partner Glycomics Industry Fund (GIF)	2023	<i>Not Disclosed</i>	Everest-Dass, Arun; Von Itzstein, Mark	Not disclosed

Grant name	Year funding commences	Project	Investigators	Total funds awarded \$AUD
DONATIONS				
Leducq Foundation Research Grant	2023	<i>Vaccination to prevent infection with Streptococcus pyogenes and rheumatic heart disease: A clinical development program</i>	Good, Michael; Pandey, Manisha; Reynolds, Simone; Ozberk, Victoria; Lepletier, Ailin	5,040,434
Raymond Swinburne James Donation	2024	<i>Professorial Chair – Director Institute for Glycomics</i>	Von Itzstein, Mark	2,000,000
Ovarian Cancer Research Foundation Research Grant	2023	<i>Discovery of novel serum glyco-markers to facilitate early detection of ovarian cancer</i>	Jennings, Michael Paul; Mountford, Carolyn; Kolarich, Daniel; Shewell, Lucy	444,203
The Bourne Foundation Donation	2023	<i>Improvement of the Prostate Specific Antigen (PSA) test, and novel biomarker discovery, by detection of a cancer-specific carbohydrate, Neu5Gc</i>	Jennings, Michael; Shewell, Lucy; Kolarich, Daniel; Day, Christopher	325,000
Thyne Reid Foundation Donation	2023	<i>Evaluating the efficiency of a meningococcal vaccine against gonorrhoea. The GoGoVax Trial.</i>	Seib, Kate	Not disclosed
Amy & Jinny Wang Family	2023	<i>Student Scholarships Support at Institute for Glycomics</i>	Von Itzstein, Mark	270,000
The Hay Family Benevolent Fund Donation	2023	<i>Supporting Discovery and Translation through the Melanoma CellBank and PhD Student Scholarship top-up Support</i>	Von Itzstein, Mark; Everest-Dass, Arun; Maggioni, Andrea	250,000
T&C Investments Pty Ltd Donation	2023	<i>Transforming Early-Stage Diagnostics for Colon and Lung Cancer – PhD Student Scholarship top-up support</i>	Von Itzstein, Mark; Kolarich, Daniel; Everest-Dass, Arun	75,000
Maureen Stevenson	2023	<i>Donation to PhD top-up support in the area of 'Vaccine Technology Development'</i>	Good, Michael	60,000
National Foundation for Medical Research and Innovation Research Grant	2024	<i>Dr John Raftos AM Award</i>	Good, Michael	50,000
Amy & Jinny Wang Family	2023	<i>Donation to Institute for Glycomics Director Strategic Fund</i>	Von Itzstein, Mark	10,000
Glycomics Circle	2023	<i>Donation to Women in Research through Glycomics Circle</i>	Von Itzstein, Mark	8,000





REMARKABLE PEOPLE

Membership in 2023

Leadership Team

Director: Professor Mark von Itzstein AO

Deputy Director: Professor Michael Jennings

General Manager: Dr Chris Davis

Associate Director (Research): Professor Kate Seib

Associate Director (Education and Engagement): Professor Victoria Korolik

Business and Operations

Tracy Anderson

Dr Ben Bailly

Dr Michael Batzloff

Nancy Callaghan

Dr Phil Ellery

James Endelman

Scott Feely

Dr Taylor Garget

Dr Lauren Hartley-Tassell

Philip Hodgson

Eloise Keeffe

Nina Kristensen

Dr Carie-Anne Logue

Yuqian (Erica) Luan

Sarah Lukic

Annalise Ok

Faith Rose

Dr Catherine Tindal

Heather Weekes

Principal Research Leaders

Professor Michael Good

Professor Michael Jennings

Professor Daniel Kolarich

Professor Carolyn Mountford

Professor Nicolle Packer

Professor Kate Seib

Professor Mark von Itzstein

Research Leaders

Dr John Atack

Dr Chris Day

Dr Darren Grice

Dr Grant Hansman

A/Professor Thomas Haselhorst

A/Professor Lara Herrero

A/Professor Todd Houston

A/Professor Milton Kiefel

Professor Victoria Korolik

Professor Johnson Mak

A/Professor Manisha Pandey

Dr Ian Peak

Dr Santosh Rudrawar

A/Professor Danielle Stanisic

A/Professor Erik Streed

Professor Joe Tiralongo

A/Professor Thomas Ve

Associate Research Leaders

Dr Patrice Guillon

Dr Freda Jen

Dr Penny Rudd

Dr Evgeny Semchenko

Dr Mehruz Zaman

Dr Larissa Dirr

Research Scientists

Merrina Anugraham

Alice Ascari

Abduliken Bake

Luke Blakeway

Dr Oren Cooper

Guilherme De Souza

Dr Belinda de Villiers

Dr Ibrahim El-Deeb

Sharareh Eskandari

Dr Arun Everest-Dass

Wesley Freppel

Vasilli Kasimov

Ailin Lepletier

Thomas Litfin

Andrea Maggioni

Alpesh Malde

Arti Medhavy

Biswa Mishra

Joanna Musick

Natali Naude

Dr Victoria Ozberk

Thilini Padeniya

Zachary Phillips

Jessica Poole

Rajaratnam Premraj

Sheethal Reghu

Simone Reynolds

Lisa Rich

Hamidreza Sadegh

Yun Shi

Aroon Supramaniam

Robin Thomson

Greg Tram

Yaramah Zalucki

Yuan Zhang

Research Assistants

Sarah Andersen

Callum Bennett

Mark Burgess

Ainslie Calcutt

James Carter

Xiaofan (Amber) Chen

Cassia Conceicao Goulart

Xavier De Bisscop

Zac Doan

Nuala Ellaby

Soulat Farooq

Mei Fong Ho

Stephanie Holt

Juniper Lethbridge

Brody Mallard

Veronika Masic

Tamim Mosaiab

Samantha Pratt

Christie Short

Rosemary Tripp

Eduardo Vasquez

Research Students

Sarah Andersen
Samuel Chambers
Jason Chang
Pauline Dizon
Lily Howell
Riddhika Lodhari
Ella McCutcheon
Charlotte McHenry
Habeebah Owolabi
Samantha Pratt
Cassandra Reynolds
Yan Yan (Victoria) Tang
Skye van Esch
Arjuna Abitbol
Punita Aggarwal
Allysha Bishop
Erwan Bremaud
Xiaofan (Amber) Chen
Plabon Das
Xavier De Bisscop
Nirosha Dilrukshi
Ashley Fraser
Jessica Halliday
Alex Johnston
Sini Hannele Kirjavainen
Yong Qian (Tracy) Koo

Danielle Lee
Gael Martin
CMA Gause Miraj
Sam Nozuhur
Valentin Slesarenko
Asma Talukder
(Caroline) Chun Thng
Ayesha Zahid

Visiting Scientists / Adjunct & Emeritus Appointments

Ralf Altmeyer
Ifor Beacham
Jason Beard
Ian Bennett
Sue Berners-Price
Helen Blanchard
Jillian Borthwick
Lisette Brock
Matthew Campbell
Nic Crampton
David Crompton
Nicholas Farrell
James Fink
George Fu Gao
John Gerrard
John Irvine

Susanne Jeavons
Emil Johansson
Lorraine (Laurie) Kear
Soerge Kelm
Natkunam Ketheesan
John Lancashire
Darren Lukas
Peter Malycha
Laura Mariano
Lewis Perrin
Mario Pinto
Gorane Santamaria
Peter Seeberger
Lucy Shewell
Nathan Tosh
Alessandra Tozzi
Rosanna Tremewan
Lorne Tyrrell
Subhash Vasudevan
E. Russell Vickers
Julia Watson
Simon Wood
Yueudong Yang
Ross Young
Xing Yu
Yaoqi Zhou

Our Scientific and Business Advisory Board



Dr George Morstyn

Dr George Morstyn has more than 25 years' experience in the biotechnology industry and currently holds the role of Non-Executive Director at Actinogen Medical, an ASX-listed, biotechnology company developing a novel therapy for neurological diseases associated with dysregulated brain cortisol.



Associate Professor Mark Smythe

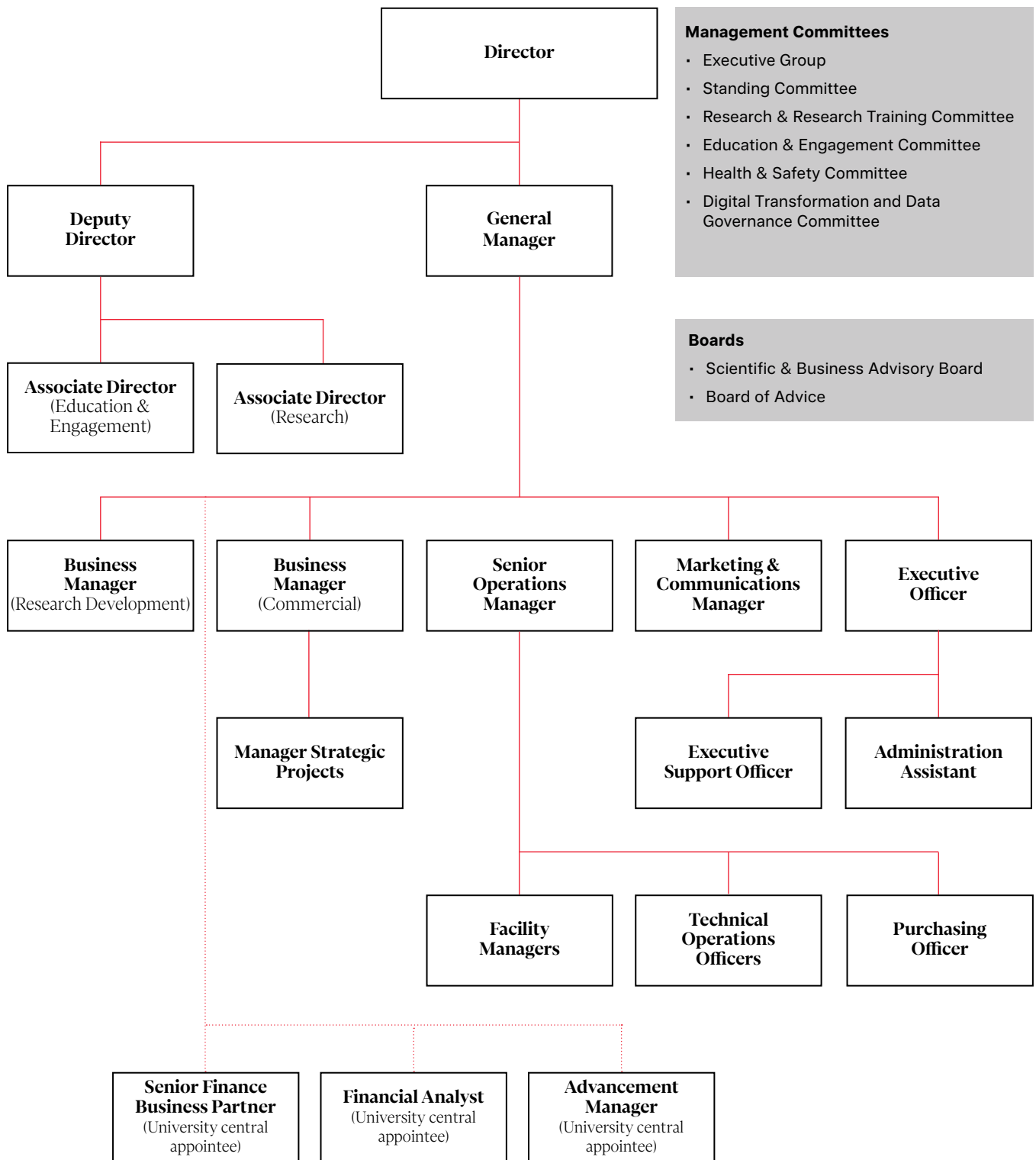
Associate Professor Mark Smythe is Principal Research Fellow at the University of Queensland's Institute for Molecular Bioscience. His research interests include combinatorial chemistry and molecular design, protein-protein interactions, molecular design and combinatorial chemistry.



Professor Ross Coppel

Professor Ross Coppel is currently Deputy Dean and Director of Research of the Faculty of Medicine, Nursing and Health Sciences at Monash University. His laboratory is involved in research into malaria and tuberculosis infection. He is also Director of the Victorian Bioinformatics Consortium.

Institute for Glycomics Organisational Structure



Our projects cut across multiple disciplines to apply new approaches to the identification, treatment and prevention of diseases.



Our Board of Advice



The Honourable Robert Borbidge AO



Mr Pat Crotty



Mr Luke O'Dwyer



Mr Paul Sanders



Ms Christine Lohman MBA, FAICD, FPRIA



Ms Karen Phillips



Mr Sam O'Connor MP



Ms Rachel Hancock



Mr Clayton Glenister



Ms Lucy Cole



Mr William Matthews



Mr Geoffrey Thomas AO

The Honourable Robert Borbidge AO (Chair)

The Honourable Robert Borbidge was the 35th Premier of Queensland and served in the State Parliament for just over 20 years. Rob is Chair of Experience Gold Coast which includes Destination Gold Coast, Study Gold Coast, Major Events GC, HOTA and Placemakers.

Mr Pat Crotty (Deputy Chair)

After a long career in the Queensland Police Service, Pat served as the State Secretary of the National Party of Australia QLD from 1997 – 2002. Pat has spent the past 14 years working in real estate on the Gold Coast and currently works at Vertullo Professionals Real Estate at Paradise Point.

Mr Luke O'Dwyer

Luke is a former National Rugby League professional with a playing career that spanned 10 years with Parramatta Eels and the Gold Coast Titans. Transitioning from the game, Luke redirected his focus towards the realm of business. He seamlessly transitioned into the role of Business Development Executive with the Gold Coast Titans, leveraging his strategic mindset and passion for growth to drive success within the organisation.

Luke continued venturing into the corporate landscape, assuming the position of Commercial Director at PhoneAFlight, a subsidiary of the renowned TripADeal. Over the past 8 years, he has ascended to the role of Head of Sales for TripADeal, now playing a pivotal role in propelling TripADeal to its status as one of the fastest-growing travel companies in Australia.

Mr Paul Sanders

Paul Sanders is a remarkable example of excellence in sports administration and governance, supported by his membership of the Professional Golfers Association of Australia. His academic qualifications as a Griffith University graduate, coupled with his strong leadership skills and his ambition to impose positive cultural impact, continue to allow Paul to excel in his profession. As an inspirational leader, he drives success and takes pride in empowering others to reach their full potential.

Ms Christine Lohman MBA, FAICD, FPRIA

Christine has more than 35 years' experience specialising in corporate and financial relations. She owned and operated one of Queensland's leading public relations companies, providing strategic communication counsel to ASX listed Companies and Government. She is an experienced non-executive director having served on several Boards, currently a GC Forum member of the Australian Institute of Company Directors and Queensland Gives GC Committee.

Ms Karen Phillips

Karen's background spans 26 years of extensive experience in sectors including media, tourism, strategic partnership management, women in business, and non for profit. She is also a professional speaker and trainer having worked with some of the world's leading brands, heads of state and national companies. Karen is a passionate advocate and contributor to both Queensland and the Gold Coast. Over the past two decades she has served on a selection of key community boards. In 2018, Karen was awarded Gold Coast Citizen of the Year for distinguished service to the Gold Coast community. She is Executive Director of both Queensland Women in Business and the Women in Business Awards of Australia.

Mr Sam O'Connor MP

Sam was elected to the Queensland Parliament as the Member for Bonney in 2017. He is a passionate advocate for the community he represents, which includes Griffith University, and works hard to engage more people in our political system. Sam holds a Bachelor of Science in Biomedical Science, so he has a particular interest in the promotion and communication of science with the general public.

Ms Rachel Hancock

Rachel was appointed editor of the Gold Coast Bulletin at the end of 2018, moving her family to the Coast from Brisbane where she was deputy editor of The Courier Mail and Sunday Mail. She started her career in South Australia, where she held several roles including Day Editor, Deputy Editor (Saturday) of The Advertiser and Deputy Editor of Adelaide's Sunday Mail. She was also the first female editor of one of the country's most quirky and successful tabloids, the NT News.

Mr Clayton Glenister

Clayton is Managing Partner of MBA Lawyers, one of the Gold Coast's longest-running law firms established in 1970. Recognised as an industry leader for body corporate law and management rights in Queensland and New South Wales, Clayton's expertise also spans corporate, commercial, property and business law, thus providing a broad focus across vital sectors of the city's economy. Clayton is a proud advocate for the Gold Coast, taking on community and corporate roles that reflect his belief in its future. One of these roles is as a Director of the Southport Sharks.

Ms Lucy Cole

Lucy is a respected business identity included in the official list of "100 most influential Gold Coasters". Her high-profile brand is associated with the finest in residential real estate and recognised continually in the Gold Coast Business Excellence awards. Lucy is actively involved with many community groups, charities, schools, universities and hospitals supporting them in major fundraising programs and is a benefactor to the Home of the Arts.

Mr William Matthews

Will has led a diverse career as an auditor and senior consultant across international trade and finance, health care, tourism, and non-for-profit sectors in Australia and Asia Pacific. Will is the founder and Director of Sovereign Family Offices, Queensland's most in-depth administrative, private care, crisis and lifestyle management service for high net worth individuals and their families, specialising in serving clients with dementia and limited capacity. Will is a passionate community leader, mentor and seniors advocate and currently serves on the boards of several not-for-profits and advisory committees.

Mr Geoffrey Thomas AO

Geoffrey currently owns Maleny Manor the most awarded wedding venue in Queensland, Settlers Rise winery and Carbrook Nursery. Geoffrey's business ventures have covered many Owner/ Executive Chairman positions including Capitalcorp Financial Services, Australian Capital Home Loans, Capitalcorp Finance and Leasing, Austcorp Finance and Leasing.



Our vision for the future

We look forward to continuing our research with enthusiasm and determination in the year ahead to discover and develop next generation drugs, vaccines and diagnostics in our fight against diseases of global impact.

Contact us

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