4th GRIFFITH CROSS-INSTITUTE SYMPOSIUM 2024

Sparking Synergy: A Catalyst for Biomedical, Materials Science, and AI

9:00 am – 5:00 pm
Friday 5th April 2024
Nathan Campus N22: Lecture Theatre 1

SPONSORS

Griffith UNIVERSITY
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ACKNOWLEDGEMENTS

Griffith University acknowledges the Traditional Custodians of the land on which we are meeting and pays respect to the Elders, past and present, and extends that respect to all Aboriginal and Torres Strait Islander people.

The 4th Griffith Cross-Institute Symposium organizing committee would like to extend their thanks to the Griffith students and staff for their participation and willingness to showcase their work. To the judges for their attendance, fairness and careful analysis of the research presented throughout the day – thank you.

Finally, we would like to take a moment to acknowledge and extend our thanks to Institute for Glycomics, Queensland Micro and Nano Science and Griffith Institute for Drug Dicovery who have kindly provided financial support for this event. We would like to thank Griffith University for providing the venue.

Many thanks to our trade display sponsors: Bio Strategy, Cytiva, John Morris and Rowe Scientific for their contribution to this event. Our appreciation is extended to Eppendorf for their sponsorship of an oral award.

We are extremely grateful for all the support received, for without it we would not be able to host the event and provide lunches, tea breaks, awards and post-event celebrations.

THANK YOU

DEFINITIONS

"Synergy"

Definition in English:

1. the **interaction** or **cooperation** of two or more organizations, substances, or other agents to produce a combined effect greater than the sum of their separate effects.

Origin:

Greek. Mid 17th century (denoting cooperation): from modern Latin synergia cooperation, from Greek sunergia, from sunergos 'working together', from sun- 'together' + ergon 'work'.

Source: Oxford Dictionaries

Please note, we welcome all the attendants to join us in discussing the **art** of applying our respective **knowledge** to result in **practical** solutions towards Biomedical advancements, **through the Networking and Social event which will be held outside the lecture hall from 5:15 pm onwards.**

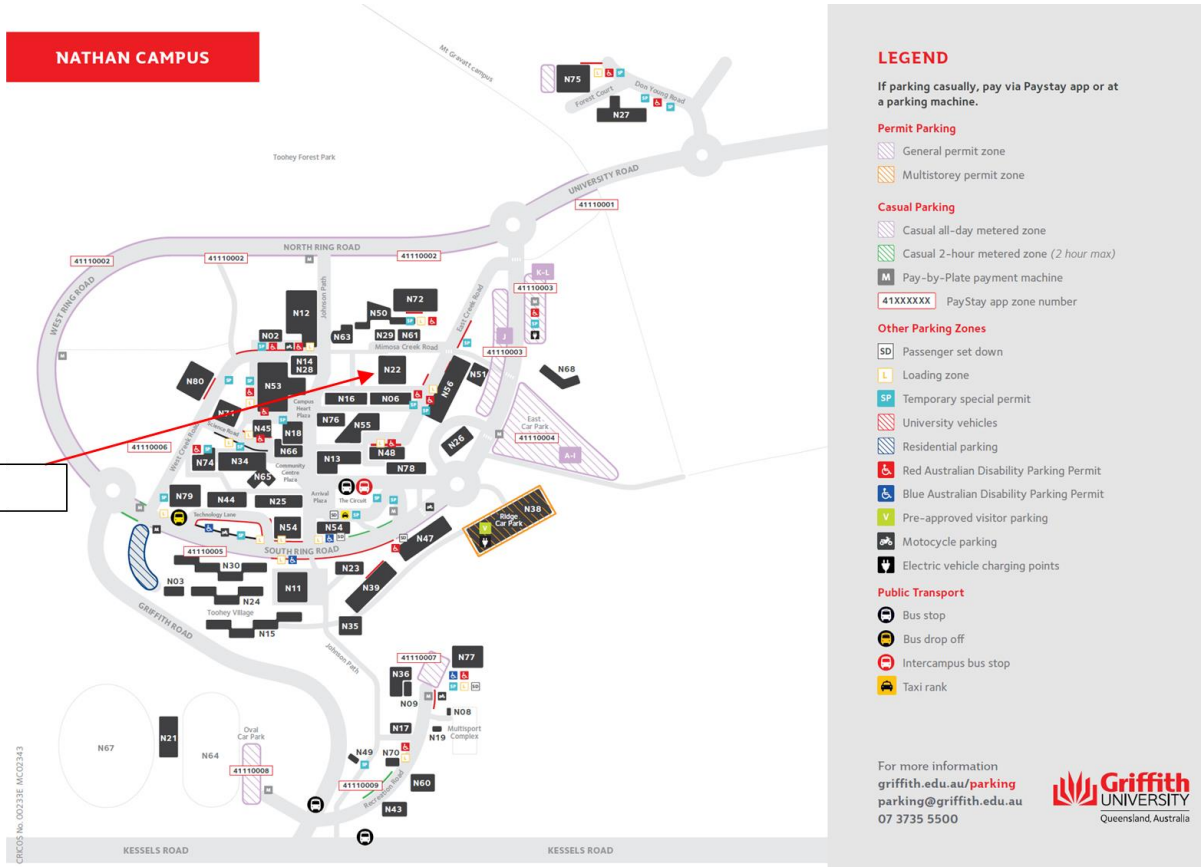
A **bus service** for transportation between the Gold Coast and Nathan campuses is available.

Pick-up is at Griffith University Southport Campus, **Bus stop at student Cr between G43 and G33 at 07:00 am** on 5th April 2024. The destination is the Griffith N22 northern theatres Nathan Campus. Departure time from Nathan campus back to the Gold Coast campus will be at **6:30pm from the bus stop in front of N79.**

VENUE

Nathan Campus – N22 Northern Theatres

Venue N22

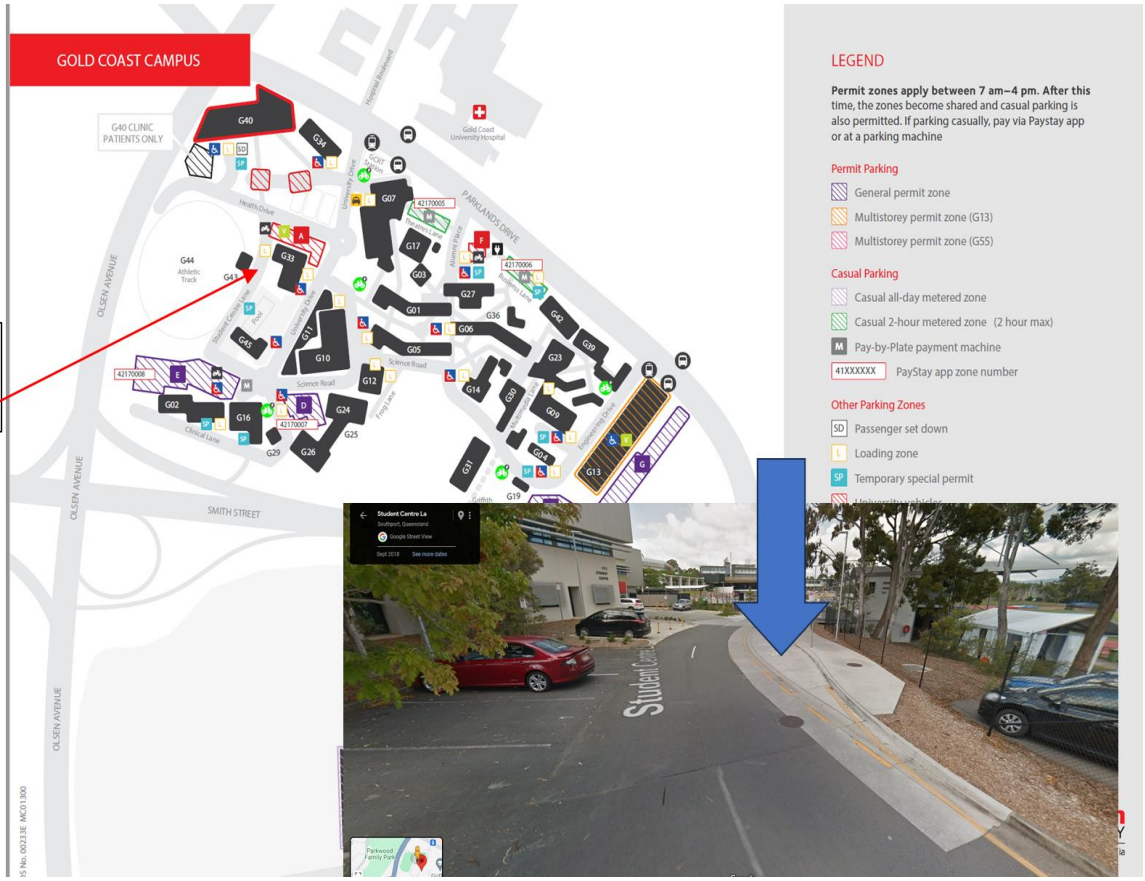


TRANSPORT INFORMATION

Gold Coast Campus

Morning pick up point at Gold Coast Campus: G44, Southport, QLD 4215

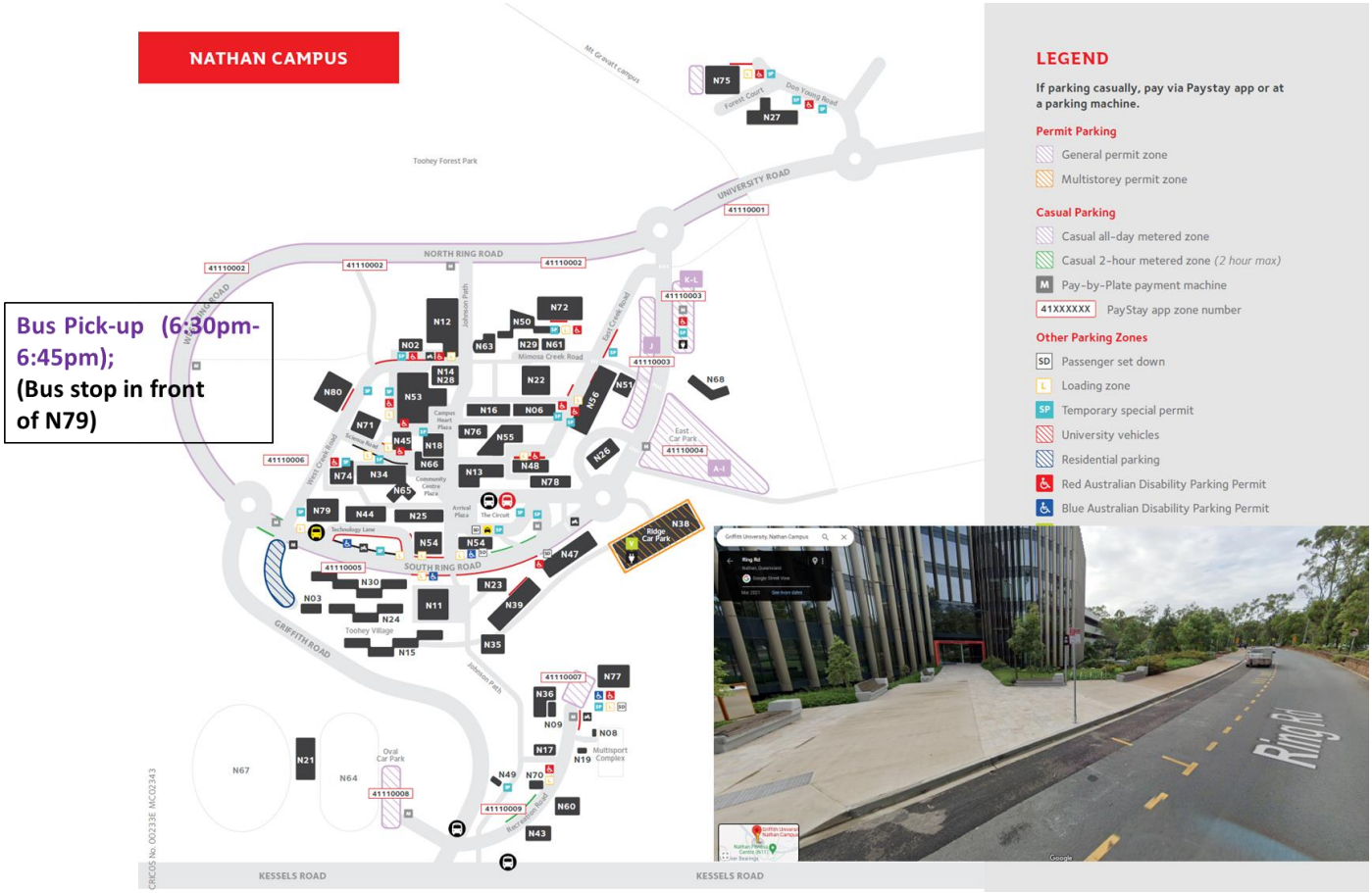
Bus pick up(7:00-7:15 am)
(Bus stop at Student Cr between G43 and G33)



TRANSPORT INFORMATION

Nathan Campus

Evening pick up point at Nathan Campus: N79, Ring Road& W Creek Rd, Nathan QLD 411



PROGRAM

8:30 - 9:00	***Registration and morning tea***	
9:00 - 9:15	***Opening and Introduction***	
Session 1	***Title: Keynote speaker session*** *Chair: Dr Jun Zhang* *Co-Chair: Dr Belinda de Villiers*	
9:15 - 10:00	**O1: Keynote Speaker** Prof. Nam-Trung Nguyen Griffith University nam-trung.nguyen@griffith.edu.au	Handicraft, art, languages - a geek's journey in science and technology
10:00 - 10:45	**O2: Keynote Speaker** Dr. Frank Sainsbury Institute for Drug Discovery f.sainsbury@griffith.edu.au	Engineered virus capsids as nanoscale containers and compartments
10:45 - 11:00	***Morning tea***	
	Session 2 *Chair: Dr Quang Thang Trinh* *Co-Chair: Dr Jamila Iqbal*	
11:00 - 11:20	**O3**: Dr Shehzahdi Shebbrin Moonshi QMNC s.moonshi@griffith.edu.au	Polysuccinimide-based Nanoparticle: A Nanocarrier with Unique Drug Release Delay and Zero Burst Release Properties for Effective Theranostics of Cancer
11:20 - 11:40	**O4**: Mr Lingxi Ouyang QMNC lingxi.ouyang@griffithuni.edu.au	Destabilising Surface Bubbles with Excessive Bulk Oversaturation
11:40 – 12:00	**O5:** Dr Lan Xiao School of Medicine and Dentistry l.xiao@griffith.edu.au	Photo-triggered Multifunctional Gold-based Hybrid Nanoflowers Promote Infectious Skin Regeneration
12:00 – 12:45	***Group Photo and Lunch***	
12:45 – 13:20	***Poster session 1***	
	Session 3 *Chair: Dr Mariyam Murtaza* *Co-Chair: Dr Megha Mohan*	
13:20 – 13:40	**O6:** Mrs Etianne Martini Sasso National Centre for Neuroimmunology and Emerging Diseases (NCNED)-Menzies e.martinisasso@griffith.edu.au	In vitro treatment with Naltrexone restores TRPM3 ion channel function in NK cells from Long Covid patients
13:40 – 14:00	**O7:** Ms Breanna Weigel	Patient-reported health outcomes are comparable between people with

	National Centre for Neuroimmunology and Emerging Diseases (NCNED)-Menzies breanna.weigel@griffithuni.edu.au	Myalgic Encephalomyelitis/Chronic Fatigue Syndrome and Post COVID-19 Condition over time
14:00 – 14:20	**O8:** Ms Kuruwita Arachchige Hasitha Udayangi Kuruwita School of Medicine and Dentistry hasitha.kuruwitaarachchige@griffithuni.edu.au	Advancing cardiac care: AI-Driven Detection of Ectopic Beats in Electrocardiography
14:20 - 14:40	**O9**: Mr Plabon Kumar Das Institute for Glycomics plabon.das@griffithuni.edu.au	Unveiling host-cell glycosylation changes upon parainfluenza virus infection
14:40 – 15:00	**O10**: Dr Oren Cooper Institute For Glycomics o.cooper@griffith.edu.au	Novel Siglec Targeting Using Multivalent Sialyllactose Decorated Carbon Dots
15:00 – 15:40	***Afternoon tea and poster session 2***	
	Session 4 *Chair: Dr Yun Shi* *Co-Chair: Dr Sharda Yadav*	
15:40 - 16:00	**O11**: Dr Yuao Wu QMNC yuao.wu@griffith.edu.au	Chitosan matrix containing both nanoceria and superparamagnetic iron oxide nanoparticles: a dual antioxidative and pro-oxidative nano-cocktail for theranostics of inflammatory diseases and cancer
16:00 – 16:20	**O12**: Dr Ziwei Zhou GRIDD ziwei.zhou@griffith.edu.au	Comparative Analysis of 2D and 3D Cell Culture of Human Olfactory Ensheathing Cells Using RNA-Sequencing Techniques
16:20 – 16:40	**O13:** Ms Yady Senayda Garcia Castillo GRIDD y.garciacastillo@griffith.edu.au	Structural analysis and ion dynamics studies of materials for batteries using Nuclear Magnetic Resonance
16.40-16.55	**Judge delegation/Guest talk**	
16:55 – 17:15	***Closing, prize presentation and photos***	
17:15– 18.30	***Social networking-buffet tea/coffee***	

POSTER PRESENTATIONS

Poster session 1	**13:00-13:30**
P1- Bacterial Ghosts: A Breakthrough Approach to Cancer Vaccination Muneera Anwer Menzies Health Institute muneera.anwer@griffithuni.edu.au	
P2 - Olfactory Ensheathing Cells and Fibroblasts: Dynamic Partners in Nervous System Repair and Regeneration Francesca Oieni Griffith Health, Pharmacy and Medical sciences francesca.oieni@griffithuni.edu.au	
P3 - Engineered extracellular vesicle-directed repression of SARS-CoV-2 Paniz Shirmast Menzies Health paniz.shirmast@griffithuni.edu.au	
P4 - Determination of the role of TRP channels in intracellular Ca2+ signalling in Natural killer cells using live confocal imaging Chandi T Magawa MHIQ, National Centre for Neuroimmunology and Emerging Diseases c.magawa@griffith.edu.au	
P5 - Digital health interventions for post-operative recovery in children: a systematic review Karin Plummer School of Nursing and Midwifery k.plummer@griffith.edu.au	
P6- The appeal of siRNA-Based Treatment for Merkel Cell Carcinoma: Present Understanding and Prospective Perspectives Trairong CHOKWASSANASAKULKIT School of Pharmacy and Medical Sciences trairong.chokwassanasakulkit@griffithuni.edu.au	
P7 - Altered Functional Connectivity in ME/CFS using 7 Tesla MRI Maira Inderyas National Centre for Neuroimmunology and Emerging Diseases (NCNED) m.inderyas@griffith.edu.au	
P8 - Chemoenzymatic synthesis of cyclic ADP ribose derivatives as chemical probes for nucleotide binding proteins Gause Miraj Institute for Glycomics gause.miraj@griffithuni.edu.au	
P9 - Screening virtual HDAC inhibitor libraries using QSAR in silico prediction models as a drug discovery tool for malaria Wisam Dawood Griffith Institute for Drug Discovery wisam.dawood@grffithuni.edu.au	
P10 - Structural and biochemical characterization of an antiphage defence system in Bacillus subtilis Biswa Prasanna Mishra Institute for Glycomics b.mishra@griffith.edu.au	

Poster session 2	**15:00-15:30**
P11 - Haemostatic sponges for the emergency treatment of bleeding Akrit Nepal QMNC akriti.nepal@griffithuni.edu.au	
P12 - Novel polymeric nanoparticles to advance the treatment of atherosclerosis Binura Perera QMNC binura.perera@griffithuni.edu.au	
P13 - Cardio-metabolic protection by inducible hyperbilirubinaemia Sitara Shameem Pharmacy and medical sciences sitara.shameem@griffithuni.edu.au	
P14 - Exploring the cellular roles of carbonic anhydrase III and finding new binding partners Yezhou Yu Griffith Institute for Drug Discovery yezhou.yu@griffithuni.edu.au	
P15 - Three-dimensional cell nerve bridges: a promising therapy for spinal cord injury Md. Mahbubur Rahman Griffith Institute for Drug Discovery mdmahbubur.rahman@griffithuni.edu.au	
P16 - Circular RNA expression patterns associated with schizophrenia regulate cell adhesion and migration processes in patient-derived olfactory neuronal stem cell Oak Hatzimanolis Griffith Institute for Drug Discovery oak.hatzimanolis@griffithuni.edu.au	
P17- Chromatographic Fingerprint of Barringtonia acutangula Saponins Matilda Houston Griffith Institute for Drug Discovery matilda.houston@griffithuni.edu.au	
P18- Traditional Aboriginal Medicine- Development of An Indigenous Analgesic Topical Tabassum Jannat Griffith Institute for Drug Discovery tabassum.jannat@griffithuni.edu.au	
P19- Developing a Native Mass Spectrometry Platform to Investigate Ligand Interactions with Tuberculosis-Related Membrane Proteins Xinru Xue Griffith Institute for Drug Discovery xinru.xue@griffithuni.edu.au	
P20- Label-Free Ligand Identification Tin Mak Griffith Institute for Drug Discovery t.mak@griffithuni.edu.au	

AWARDS

Research Excellence:

Oral Presentations:

1st Prize $300

2nd Prize $300

Poster Presentations:

1st Prize $200

2nd Prize $200

Audience participation prize: $200

This award is for a member of the audience who asks the best question(s) and engages with the speakers. We want to encourage questions and engagement from all participants, as ultimately this is what makes an exciting and interesting symposium.

Don't be afraid to ask anything!

Griffith ECR symposium website

Information about Griffith ECR symposium and program booklet is available on Griffith ECR symposium website. www.gcisymp.org

FOOD ALLERGEN STATEMENT

Please note that food provided at this symposium may contain traces of milk, eggs, fish, crustacean shellfish, tree nuts, peanuts, wheat and soybeans amongst other known allergens. Consumption is at your own risk and Griffith University cannot be held responsible for adverse reactions.

There will be vegetarian options, free of gluten, lactose, dairy, nuts, passion fruit, ham, mushroom, or seafood. There will also be Halal options available, please speak to the organizing team for advice.

ORAL PRESENTATIONS
Session 1

O1: Plenary Speaker Oral presentation

O1: Handicraft, Art, Languages - A Geek's Journey in Science and Technology

Prof Nam-Trung Nguyen

Abstract:
In this talk, I will share my personal journey of competitive research in science and technology. I will present how hands-on skills, curiosity and appreciation of art and languages affect my thought process, leading to innovation and discovery. I will present how my research interest evolves over time, addressing and providing solutions to the latest technological challenges. The talk will conclude with examples of my team's on-going research in micro elastofluidics.

Biography:
Nam-Trung Nguyen is a professor and an ARC Laureate Fellow at the Queensland Micro- and Nanotechnology Centre (QMNC), Griffith University, Australia. He received his Dip-Ing (M. Eng.), Dr Ing (Ph. D.) and Dr Ing Habil (professorial qualification) degrees from Chemnitz University of Technology, Germany. During his career, he was a postdoctoral research engineer at the University of California at Berkeley, USA in 1998, a faculty member at the Nanyang Technological University, Singapore from 1999 to 2013 and a Professor and Director of Queensland Micro- and Nanotechnology Centre at Griffith University from 2013 to 2023. Starting in 2024, Prof Nguyen is an ARC Laureate Fellow at the Queensland Micro- and Nanotechnology Centre (QMNC), Griffith University.

Prof Nguyen's research focuses on microfluidics, nanofluidics, micro/nanomachining technologies, micro/nanoscale science, and instrumentation for biomedical applications. He has published over 500 journal papers and filed 8 patents, of which 3 were granted. Prof. Nguyen was named as one of the top 17 Australian researchers in Chemical & Material Sciences by the Research Special Report of The Australian in 2020, 2021 and 2022 and continuously listed in the Stanford top 2% most influential scientists globally since 2021. In 2023, he was granted an ARC Laureate Fellowship, which is the ultimate research fellowship in Australia, to propel his exciting field of research of micro and elastofluidics.

O2: Plenary Speaker Oral presentation

O2: Engineered virus capsids as nanoscale containers and compartments

Dr. Frank Sainsbury

Abstract:
Virus-like particles (VLPs) assembled from the coat proteins of virus capsids have emerged as useful nanoscale structures for applications in biotechnology and nanotechnology. From well-known applications like vaccines and gene delivery vectors, their potential for encapsulation also enables biocatalytic nanoreactors, drug delivery, and templating inorganic materials. As a platform for industrial applications, VLPs offer a unique combination of high fidelity self-assembly, amenability to engineering with molecular precision, and production that is biocompatible and scalable. My research group aims to understand capsid assembly in order to apply rational engineering principles to VLP assembly in vivo and in vitro, biomolecular cargo encapsulation, and biohybrid materials. We use a diverse range of cross-disciplinary techniques, which are supported by key collaborations. I will present recent work on improving the programmable self-sorting of biomolecular cargos in vivo, re-directing capsid assembly using DNA scaffolds, and interfacing VLPs with peptide-stabilised emulsions. The key message of these exciting outcomes is that the most productive and impactful research synergy can be found where it is least expected.

Biography:
Dr Frank Sainsbury is a research leader in physical virology at the Griffith Institute for Drug Discovery, Griffith University. His research group is primarily interested in virus capsids, pushing the boundaries of how they assemble and what can be learned from using them as biochemical reaction vessels and delivery vehicles. Dr Sainsbury trained as a plant virologist at the John Innes Centre in the UK. His work there included the invention of protein expression systems in plants that have supported Phase III clinical trials of influenza vaccine candidates and led to a major UK innovation award. Since returning to Australia to take up an ARC DECRA Fellowship at UQ in 2014, he has developed an innovative program of research into the assembly, engineering, and uses of virus-like particles. He was since awarded a CSIRO Synthetic Biology Future Science Platform Fellowship to explore the directed assembly of virus coat proteins into protein cages with non-natural geometries. In 2023, he was awarded an ARC Future Fellowship to use a synthetic virology approach to evolving virus capsids for applied uses in agriculture and health.

ORAL PRESENTATIONS
Session 2

O3: Polysuccinimide-based Nanoparticle: A Nanocarrier with Unique Drug Release Delay and Zero Burst Release Properties for Effective Theranostics of Cancer

Shehzahdi S. Moonshi1, Karla X. Vazquez Prada1,3,6, Hossein Adelnia1,3, Nicholas J. Westra van Holthe3,4, Yuao Wu1, Joyce Tang1,2, Andrew C. Bulmer5, Hang Thu Ta1,2,3*

1 Queensland Micro- and Nanotechnology Centre, Griffith University, Brisbane, Australia
2 School of Environment and Science, Griffith University, Brisbane, Australia.
3 Australian Institute for Bioengineering and Nanotechnology, University of Queensland, Brisbane, Australia
4 Centre for Advanced Imaging, University of Queensland, Brisbane, Australia
5 School of Pharmacy and Medical Sciences, Griffith University, Brisbane, Australia
6 Memorial Sloan Kettering Cancer Center, New York, United States

We have developed a novel pH-responsive delivery system consisting of oleylamine-modified polysuccinimide (PSI-OA) NPs whereby NPs remained stable and started to release bioactive agents (Curcumin and IR-780) after 8.5 h with maximal release acquired after 36 h under physiological pH. Our NPs did not exhibit any burst release of drug, which is a key advantage in anti-cancer targeted drug delivery system. PSI-OA NPs were prepared via emulsion evaporation method. We assessed the photothermal cytotoxicity of our targeted and non-targeted NPs based on the temperature elevation and cell viability of treated U87MG cells. We assessed the in vivo photothermal therapeutic efficacy of NPs in a subcutaneous U87MG murine model. Photoacoustic and fluorescence imaging were performed in mice injected with targeted and non-targeted NPs to ascertain accumulation of NPs in the tumours. Targeting folate receptors on cancer cells significantly augmented in vitro cytotoxicity of NPs towards cancerous U87MG cells (74.1% cell death) and photothermal laser resulted in enhanced synergistic ablation of U87MG cells (~100% cell death). Intravenous administration of NPs in U87MG model effected in a substantial decrease in tumour and photothermal laser exposure (808 nm) further ablated the tumours to an almost total eradication of tumours. NPs demonstrated selectivity through enhanced accumulation and retention in tumours as indicated by dual-modal imaging. Targeted NPs displayed excellent potential in the simultaneous application for a safe and successful targeted synergistic photothermal treatment and Photoacoustic imaging of cancer model.

O4: Destabilising Surface Bubbles with Excessive Bulk Oversaturation

Lingxi Ouyang,1,2 Haotian Cha,1,2 Jun Zhang,1 Helena H.W.B. Hansen,1,2 Qin Li,1,3 Beng Hau Tan,4
3 Porun Liu,2 Dongke Zhang,5 Nam-Trung Nguyen,1,2* Hongjie An1,2*

1 Queensland Micro and Nanotechnology Centre, Griffith University, 170 Kessels Road, Nathan, QLD 4111, Australia
2 School of Environment Science, Griffith University, 170 Kessels Road, Nathan, QLD 4111, Australia
3 School of Engineering and Built Environment, Griffith University, 170 Kessels Road, Nathan, QLD 4111, Australia
4 KB Corporation, 7500A Beach Road, 199591 Singapore
5 Centre for Energy (M473), The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Australia

The response and dynamics of surface-attached bubbles in gas-oversaturated environments have practical implications for industrial processes such as photocatalytic water splitting. Surprisingly, the behavior of microbubbles and nanobubbles depends rather strongly on the nucleation techniques, e.g., solvent exchange, which gives rise to stable bubbles, while other methods like electrochemical water splitting produce unstable ones. By experimentally investigating a prototypical system of bubble nucleation, we show how these outcomes are determined by a competition between gas oversaturation and contact line friction. We derive a stability line in the oversaturation-radius parameter space, which not only agrees with our experiments but also correctly predicts the outcome of previous experiments across five orders in oversaturation and bubble radius.

O5: Photo-triggered Multifunctional Gold-based Hybrid Nanoflowers Promote Infectious Skin Regeneration

Jixuan Honga,#, Jiaqi Zhua,#, Xiaxin Caoa, Boqi Panga, Jiaru Xiana, Xueqiong Yina, Qiaoyuan Denga,b,*, Maohua Chena, Ziyu Qina, Chaozong Liuc, Swastina Nath Varmac. Yin Xiaod, Lan Xiaod,* , Mengting Lia,*

a Hainan Provincial Fine Chemical Engineering Research Center, School of Chemical Engineering and Technology Hainan University Haikou, Hainan 570228, P. R. China.
b Key Laboratory of Advanced Material of Tropical Island Resources of Educational Ministry School of Materials Science and Engineering Hainan University Haikou, Hainan 570228, China.
c Institute of Orthopaedic & Musculoskeletal Science, University College London, Royal National Orthopaedic Hospital, London HA7 4LP, UK
d School of Medicine and Dentistry, Griffith University (GU), Gold Coast, QLD 4222, Australia.
#Those authors contribute equally to the manuscript and are co-first authors.
*Corresponding authors.

The skin wound-healing under infectious conditions remains challenging owing to the lack of efficient strategies to inhibit drug-resistant bacteria growth and control inflammation. Photothermal therapy shows efficient antimicrobial effects, whereas it generates excessive heat to damage tissue and inflammation to impair tissue regeneration. Herein, we develop the multifunctional gold-based nanoflowers incorporated with photosensitizer (Ce6, for PDT) and anti-inflammatory drug (bromfenac sodium/BS). This allows for a nanosystem to combine the mild-photothermal therapy (mPTT), photodynamic therapy (PDT), and drug-controlled release anti-inflammation therapy for infectious skin regeneration. Upon laser irradiation, the local temperature increased (to a mild temperature of ~45 ℃, mPTT) along with the singly linear oxygen (from PDT) for anti-infection; the release of BS was triggered for anti-inflammation. The multifunctional nanoflowers achieved 99% antibacterial efficiencies and biofilm inhibition in vitro. They showed good biocompatibility and improved wound-healing in the animal models of subcutaneous abscess and skin wound infected with drug-resistant bacteria. In addition to the antibacterial effect from mPTT and PDT, the nanoflowers regulated the immune microenvironment by controlled releasing BS, inhibiting inflammation and promoting growth factor production, collagen deposition, and angiogenesis to improve skin wound-healing. Therefore, this study provides an advanced nano-system with photo-triggered antimicrobial and anti-inflammation activities, which improves infectious skin tissue regeneration.

ORAL PRESENTATIONS
Session 3

O6: In vitro treatment with Naltrexone restores TRPM3 ion channel function in NK cells from Long Covid patients

Etianne Martini Sasso1,2,3, Katsuhiko Muraki2,4, Natalie Eaton-Fitch1,2, James N Baraniuk5, Peter Smith2, Andrew Jeremijenko1,2, and Sonya Marshall-Gradisnik1,2.

1 The National Centre for Neuroimmunology and Emerging Diseases, Menzies Health Institute Queensland, Griffith University, Gold Coast, QLD, Australia.
2 Consortium Health International for Myalgic Encephalomyelitis, National Centre for Neuroimmunology and Emerging Diseases, Menzies Health Institute Queensland, Griffith University, Gold Coast, QLD, Australia.
3 School of Pharmacy and Medical Sciences, Griffith University, Gold Coast, QLD, Australia.
4 Laboratory of Cellular Pharmacology, School of Pharmacy, Aichi-Gakuin University, Nagoya, Japan.
5 Department of Medicine, Georgetown University, Washington DC, USA.

Background: Long Covid (LC) and Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) share symptoms and Transient Receptor Potential Melastatin 3 (TRPM3) ion channel dysfunction in natural killer cells (NK). Opioid receptors (OR) inhibit TRPM3 by direct binding of Gβγ proteins, while naltrexone (NTX), as OR antagonist, negates the inhibitory function of OR on TRPM3.
Aims: Validate impaired TRPM3 from LC compared with ME/CFS and investigate NTX effects on TRPM3 function in LC.

Methods: Whole-cell patch-clamp experiments using pregnenolone sulfate (PregS) and ononetin to assess TRPM3. 1. Freshly isolated NK from N=10 LC, N=10 ME/CFS and N=10 healthy controls (HC). 2.NK from N=09 LC and N=07 HC were incubated with NTX and without (vehicle). Outcomes were analysed by Mann-Whitney, Kruskal-Wallis and Fisher's exact test.

Results: 1.PregS-induced TRPM3 currents were significantly reduced in LC and ME/CFS (both $p<0.001$) compared with HC, while were equivalent ($p>0.99$) in LC and ME/CFS. NK from LC and ME/CFS were insensitive to ononetin and differed significantly with HC (both $p<0.001$), while no difference between ME/CFS and LC ($p>0.44$). 2. NTX significantly increased PregS-induced currents in LC compared to vehicle ($p<0.001$) and were equivalent to HC PregS amplitude ($p=0.56$), and resistance to ononetin ($p=0.38$). PregS-induced TRPM3 currents from vehicle were significantly reduced in LC compared with HC ($p=0.02$), with no difference for sensitivity to ononetin ($p>0.99$).

Conclusion: NTX reversed TRPM3 dysfunction in LC, similar to previous results in ME/CFS, supporting the hypothesis of ion channel impairment in the overlap of LC and ME/CFS. Restored TRPM3 facilitates Ca2+ influx and re-establishes cell homeostasis.

Funding: This study was supported by the National Health and Medical Research Council (Australia) and the Stafford Fox Medical Research Foundation.

O7: Patient-reported health outcomes are comparable between people with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome and Post COVID-19 Condition over time

Breanna Weigel (1,2), Natalie Eaton-Fitch (1,3), Kiran Thapaliya (1,3), Sonya Marshall-Gradisnik (1,3)

1 The National Centre for Neuroimmunology and Emerging Diseases, Menzies Health Institute Queensland, Griffith University, Gold Coast, Queensland, Australia 4222
2 School of Pharmacy and Medical Sciences, Griffith University, Gold Coast, Queensland, Australia 4222
3 Disability and Rehabilitation, Menzies Health Institute Queensland, Griffith University, Gold Coast, Queensland, Australia 4222

Background:
Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and Post COVID-19 Condition (PCC) are chronic, multi-systemic illnesses requiring multidisciplinary management approaches. The present longitudinal study aims to highlight the long-term burdens of living with ME/CFS and PCC by examining patient-reported health outcomes over time in an Australian cohort.

Methods:
Data collection for this study is ongoing. The present data was collected between October 2021 and October 2023. All participants were aged between 18 and 65 years, residents of Australia, and formally diagnosed with ME/CFS or PCC by a physician. Participants completed a self-administered questionnaire at three timepoints separated by six-month intervals. Health outcome data was captured via validated patient-reported outcome measures, including the Australia-Modified Karnofsky Performance Scale, 36-Item Short-Form Health Survey version 2, World Health Organization Disability Assessment Schedule version 2.0, Modified Fatigue Impact Scale, and Dr Bell's Chronic Fatigue and Immune Dysfunction Syndrome disability scale.

Results:
The ME/CFS (n=54) and PCC (n=12) cohorts were comparable in age (median (M)=48.00, interquartile range (IQR)=15.50 years and M=52.50, IQR=12.00 years, respectively, p=0.082) and sex (n=41, 75.9% and n=8, 66.7% female, respectively, p=0.70); however, the ME/CFS participants had a significantly longer illness duration (M=14.25, IQR=15.79 years and M=0.75, IQR=0.32 years, respectively, p<0.0001). Compromised patient-reported health outcomes were observed in both cohorts across all measures except the Role Emotional domain among the PCC participants. While overall perceptions of health were higher among the PCC participants at the six-month follow-up, all other quality of life, disability, and fatigue impact measures were comparable between the two cohorts at the baseline and follow-up timepoints (all p>0.05).

Conclusions:
These findings foreground the substantial and prolonged impacts of ME/CFS and PCC on patients' lives and thereby underscore the need for accessible and holistic healthcare, disability support, and social services for people living with ME/CFS and PCC in Australia.

O8: Advancing cardiac care: AI-Driven Detection of Ectopic Beats in Electrocardiography

Hasitha Kuruwita A., School of Medicine and Dentistry, Griffith University, Gold Coast, Australia,
Shu Kay Ng, School of Medicine and Dentistry, Griffith University, Brisbane, Australia,
Alan Wee-Chung Liew, School of IT, Griffith University, Gold Coast, Australia,
Brent Richards, Critical Care Research, Gold Coast Hospital and Health Service, Gold Coast, Australia,
Luke Haseler, Curtin School of Allied Health, Curtin University, Perth, Australia,
Kuldeep Kumar, Bond Business School, Bond University, Gold Coast, Australia,
Kelvin Ross, Datarwe, Gold Coast, Australia,
Ping Zhang, Menzies Health Institute Queensland, Griffith University, Gold Coast, Australia,

Background: The application of artificial intelligence (AI) in cardiac care, particularly for the analysis of Electrocardiography (ECG) patterns, has shown promise in detecting arrhythmias and enhancing patient outcome. By leveraging advanced algorithms, AI systems can accurately identify various ectopic heartbeats, such as ventricular and supraventricular contractions, which are critical for diagnosis and treatment. Our prior research laid the ground work for utilizing real-world ECG data and clinician expertise to refine a deep-learning model aimed at improving the detection of these contraction for robust clinical application.

Methods: Deep convolutional neural network (DCNN) was developed to improve the detection of abnormal beats; those are ventricular ectopic beats (VEB) and supraventricular ectopic beats (SVEB). The proposed model was validated using publicly available annotated datasets and real-world data with clinical annotations. The models' performance was compared to existing methods and discussed, along with the feasibility of leveraging predicted labels for large-scale cardiac detection and identification. The result demonstrated the model's potential for practical clinical applications.

Findings: The model achieved reliable performance on both the internal testing data (MIT/BIH-LT+SUP) (overall area under the receiver operating characteristic curve [AUC]: 0.946; accuracy: 0.955; and sensitivity: 0.974 for VEB, 0.783 for SVEB). On the external testing set, the model achieved (MIT/BIH-AR-DS2) (overall AUC: 0.853; overall accuracy: 0.845; and a sensitivity: 0.941 for VEB, 0.525 for SVEB). After fine-tuning the hyperparameters of the model using the MIT/BIH-AR-DS1 dataset, the model was tested with an independent test dataset (MIT/BIT-AR-DS2), achieving an overall AUC: 0.976; overall accuracy: 0.973; and sensitivity: 0.927 for VEB, 0.967 for SVEB). The model was fine-tuned using expert-annotated ground-truth labels on real-world hospital data and achieved high overall ACU: 0.938 and accuracy: 0.918, and sensitivity for ectopic detection: 0.897 and 0.886 for VEB and SVEB, respectively.

Interpretation: The ectopic beat detection model presented and validated in this study represents a clinically applicable AI method capable of delivering diagnoses at patient level with comprehensible results. The potential of this model extends to the realm of clinical applications, as it offers dependable ECG labelling and lays the groundwork for more extensive analysis of heart rates.

O9: Unveiling host-cell glycosylation changes upon parainfluenza virus infection

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Human parainfluenza virus (HPIV) remains to be one of the major causes of respiratory illness all over the world. The diseases linked to HPIV infection range from mild respiratory infection to life threatening conditions such as acute bronchiolitis, pneumonia, and croup. Despite the significant efforts in designing therapeutics, there is neither an effective antiviral nor a vaccine available against HPIV.

Cellular glycosylations are known to play a pivotal role in HPIV biology. Glycans like sialic acid (Neu5Ac) have been identified as cellular receptors to HPIV and utilised as molecular template for structure-based drug design. However, dynamics of the host-cell glycome upon HPIV infection has never been studied. Herein, we profile surface glycans (N-, O-, glycosphyngolipids) decorating the cell upon HPIV-3 infection in both immortalized and primary epithelial cells using state-of-the-art mass spectrometry techniques and instruments.

We observed a significantly higher expression of oligomannose type N-glycans at the surface of infected cells when compared to mock-infected control, with correspondingly lower expression of complex type N-glycans. Unique O- and glycosphingolipids glycosylation features were also found on HPIV-infected cells when compared to their mock-infected counterpart. For the first time, these results provide insights into the cell glycome remodelling triggered by HPIV-3 infection. The outcomes of this study will provide key information related to viral pathogenesis along with the potential to identify cellular glyco-markers of HPIV infection as novel target for antiviral therapies.

O10: Novel Siglec Targeting Using Multivalent Sialyllactose Decorated Carbon Dots

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Sialic acid binding immunoglobulin-like lectins (Siglecs) are a family of receptors that regulate the innate and adaptive immune systems through glycan mediated signalling. Siglec ligand recognition is crucial for cell adhesion, cell signaling and endocytosis making them attractive targets for drug design. To this end, numerous high affinity synthetic sialoside ligands have been developed to serve as therapeutics for various Siglec driven disease states, however the role of multivalent Siglec ligands has not been studied in detail. Recently, advances in glyco-nanotechnology have allowed the development of multivalent scaffolds to explore carbohydrate-lectin interactions. Of these, carbon dots (CDs), which are inherently fluorescent and have high surface/volume ratios, represent promising scaffolds to explore in vitro and in vivo glycan-Siglec interactions. Here, we show the fabrication of high affinity α(2,3)-sialyllactose (2,3-SL) and α(2,6)-sialyllactose (2,6-SL) decorated CDs (3-CD and 6-CD, respectively) for targeting Siglec-2 (CD22) and Siglec-1 (Sialoadhesin). We outline the use of SL-conjugated CDs in biology and show that they have an inherently high affinity to bind to siglec due to their multivalent display. Finally, for 6-CD, this multivalent display of Sia, was able to generate a significant cytotoxic effect on Burkitt's lymphoma (BL) Daudi B cells. This study provides the framework for the design of intelligent Sia-conjugated CDs capable of targeting siglecs and other sialic acid binding proteins, paving the way for the development of clinically applicable CDs.

O11: Chitosan matrix containing both nanoceria and superparamagnetic iron oxide nanoparticles: a dual antioxidative and pro-oxidative nano-cocktail for theranostics of inflammatory diseases and cancer

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In this study, we established the application of nanotheranostics, employing a multifunctional nanoplatform for the simultaneous therapy and diagnosis of serious ailments such as cardiovascular diseases, inflammation and cancer. We developed a novel theranostic nanoplatform, Chit-IOCO-Cy5-MTX nano-cocktail, consisting of a chitosan matrix (Chit) loaded with both treatment module (cerium oxide nanoparticles, CO) and imaging module (iron oxide nanoparticles, IO), subsequently labelled with methotrexate (targeting ligands) and Cy5 (fluorescent ligands).

Our nano-cocktails exhibit antioxidative properties, effectively scavenging reactive oxygen species (ROS) in macrophages, key players in inflammatory diseases. In vitro results also highlighted the nano-cocktails' excellent anti-inflammatory ability in LPS-stimulated macrophages. Notably, these nano-cocktails further served as potent MRI contrast agents in macrophages. In vivo studies showed that Chit-IOCO-MTX-Cy5 has strong anti-ROS and anti-inflammatory efficacy in CCl4-induced liver inflammation model and ApoE-/- atherosclerosis mouse model. This nano-cocktail treatment significantly reduced the overexpression of inflammatory proteins and plaque formations in the aortic region, meanwhile the MRI displayed a darker signal within the liver and atherosclerotic plaque indicating its successful delivery. Interestingly, in cancer, these nano-cocktails showed pro-oxidative property, effectively promoting U-87 MG cancer cell death by increasing ROS production. They also served as potent MRI contrast agents in cancer cells. In vivo studies revealed significant inhibition and effective imaging of tumour in U-87 MG tumour-bearing BaLB/c mice treated with Chit-IOCO-MTX-Cy5.

In summary, these Chit-IOCO-MTX-Cy5 nano-cocktails present a promising theranostic nanoplatform, offering significant potential for diagnosis and therapeutic intervention of atherosclerosis, liver inflammation, and cancer.

O12: Comparative Analysis of 2D and 3D Cell Culture of Human Olfactory Ensheathing Cells Using RNA-Sequencing Techniques

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Olfactory ensheathing cells (OECs) are glial cells in the olfactory system with notable regenerative properties, making them potential candidates for treating spinal cord injuries and neurodegenerative diseases. Despite positive outcomes in animal models and human clinical trials, challenges like poor cell survival and limited migration hinder OEC transplantation efficacy. Traditional two-dimensional (2D) cell culture models have limitations in replicating the in vivo environment, prompting a shift to three-dimensional (3D) models to better mimic physiological conditions. However, the impact of this transition on OEC gene expression and functionality remains unclear. This study aims to comprehensively analyse 2D and 3D cell culture models of human OECs using RNA-sequencing techniques. The research seeks to identify differentially expressed genes, pathways, and biological processes affected by culture conditions, providing insights to enhance OEC-based transplantation therapies for spinal cord repair. Based on our results, several classic signaling pathways were significantly activated in OECs cultured in a 3D environment, including Phosphoinositide 3-kinase (PI3K)-Akt, mitogen-activated protein kinase (MAPK) and tumor necrosis factor (TNF). These findings collectively indicate that OECs cultured in a 3D environment exhibit significant activation of pathways that not only enhance cell migration and proliferation but also promote neurite outgrowth when compared to 2D cultures. The results of this research will offer valuable insights aimed at improving the outcomes of OEC-based transplantation therapies for spinal cord repair.

O13: Structural analysis and ion dynamics studies of materials for batteries using Nuclear Magnetic Resonance

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One crucial step in the development of rechargeable lithium-ion batteries, in both liquid and solid states, involves designing energy storage materials and understanding the structural changes and ion dynamics occurring in their electrolytes. Composite electrolytes, comprising organic ionic plastic crystals (OIPC) and polymers, have attracted attention due to their combined non-flammability, non-volatility, and thermal stability from OIPC, along with the thermal and mechanical stability provided by the polymer.In this study, we investigated composites involving OIPC N-methyl-N-ethylpyrrolidinium bis(trifluoromethanesulfonyl) amide, C2mpyrTFSI, and polymer nanoparticles functionalized with comonomer lithium 1–(3–(methacryloyloxy) propylsulfonyl)–1–(trifluoromethylsulfonyl)imide, LiMTFSI. Structural changes and lithium-ion dynamics in the composites were examined using Nuclear Magnetic Resonance in the solid state. Additionally, we studied liquid electrolytes consisting of lithium bis(trifluoromethane)sulfonimide (LiTFSI) salt and six different solvents. This preliminary approach aimed to determine which solvent strongly interacts with lithium ions. The strength of this interaction can promote a higher lithium diffusion coefficient, leading to increased lithium translational motion in the solution, a desired property in electrolyte materials.These studies contribute to understanding the formation of interfacial regions and the lithium-ion dynamics in these materials, advancing the design of electrolyte materials for the next generation of lithium-ion batteries.

POSTER PRESENTATIONS

P1: Bacterial Ghosts: A Breakthrough Approach to Cancer Vaccination

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Cancer is a devastating disease worldwide, causing mortalities in both males and females. It starts with the development of abnormal cells that proliferate and multiply to form tumors and metastasize to damage the healthy tissues and organs of the body. Traditional cancer therapies have severe side effects. Therefore, an advanced approach to treating cancer has become an important area of research. Immunotherapeutic cancer vaccines have emerged as a promising strategy for cancer treatment, harnessing the power of the immune system to recognize and kill tumor cells while causing minimal damage to healthy tissue and additionally providing systemic immunity. Bacterial ghosts (BGs), a novel platform in cancer vaccination, have made them suitable for personalized and effective immunotherapeutic interventions. Bacterial ghosts are empty bacterial cell envelopes generated through a controlled lysis process, leaving behind empty but structurally intact cell membranes. These BGs are loaded with tumor-specific antigens, immunostimulatory molecules, and adjuvants, creating a comprehensive antigen-presenting system capable of eliciting potent immune responses. It enhances the potential to overcome tumor-induced immune suppression. The current research focuses on the design and development of bacterial ghost-based cancer vaccines to treat epithelial cancers with long-lasting immunity.

P2: Olfactory Ensheathing Cells and Fibroblasts:
Dynamic Partners in Nervous System Repair and Regeneration

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Olfactory ensheathing cells (OECs) transplantation is emerging as promising nerve repair therapy, particularly for spinal cord injury (SCI), owing to their intrinsic regenerative capacity within the olfactory system. Perineural fibroblasts are natural partners of OECs within the olfactory nerve and co-transplantation with OECs may improve transplantation repair outcomes. However, little is known about the natural interactions of OECs and fibroblasts during the chaotic state following an injury. Using a mouse model, we temporarily damaged the olfactory nerves using methimazole. At key stages of degeneration and regeneration of the olfactory nerve, full thickness olfactory mucosae were isolated to perform wholemount immunohistology analysis. In contrast to previous reports that the OECs maintain the integrity of the nerve fascicles after injury, we observed that there was considerable disintegration of the structure of nerve fascicles and extensive remodelling over the course of injury and recovery. OECs and fibroblasts both reacted and participated in the injury stage and helped in the recovery. While the newly regenerated axons reestablished connections to the olfactory bulb, the arrangement of nerve fascicles within the lamina propria was altered. The outcomes of this study support the use of a combination cell therapy for SCI in which OECs and fibroblasts are co-transplanted, which may be more beneficial than using OECs alone. These results also have implications for diseases and infections in which the sense of smell is affected as the remodelling of the olfactory nerve fascicles may explain changes in olfactory acuity.

P3: Engineered extracellular vesicle-directed repression of SARS-CoV-2

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Introduction : In a subset of individuals afflicted with SARS-CoV-2 infection, the persistent effects of Long COVID have been documented to precipitate inflammatory processes or pathogenic invasion, potentially exacerbating clinical manifestations, for which engineered extracellular vesicles (EVs) could offer therapeutic potential. In this study, we designed and investigated the potential of engineered HEK293 EVs to suppress SARS-COV-2.

Methods : The HEK293 cell line was cultured in DMEM media supplemented with 10% FBS at 37°C and 5% CO2. Cells were transfected with plasmids expressing asRdRp/CD63/Cx43VHH72/mCherry, sorted using flow cytometry, and subjected to Puromycin drug selection to produce stable cell lines. qPCR measured asRdRp gene expression. Stable cell line was cultured using 10% EV-depleted FBS and media was collected every 48 hours, and subjected to TFF with sterile hollow fiber cartridge with 500kDa MWCO membrane (five times buffer exchange). Concentrated using Amicon® Ultra Centrifugal Filters. EVs were characterized using NTA and DLS. Co-incubation of EVs with SARS-CoV-2 Wuhan variant was followed by Plaque assay, with results statistically being analyzed.

Results : Quantitative PCR analysis revealed a significant 2.5-fold upregulation of asRdRp gene expression compared to the housekeeping gene ($p < 0.05$). DLS analysis demonstrated a monodisperse distribution of nanoparticles with a mean size of 31.34 nm (PDI = 0.459), indicating uniformity. NTA confirmed nanoparticle presence, with a concentration of 7.9x 10^12 particles/mL and a mean size of 32 nm. Both methods consistently verified particle size distribution and nanoparticle stability. Plaque assay results revealed an average plaque count of 510.6 for the untreated control group and a significant increase to 1217.3 upon treatment with engineered EVs ($p < 0.05$). Viral titers were measured at 250 PFU/well for both control and treated groups. Notably, HEK293 engineered EVs unexpectedly led to a substantial enhancement in viral replication in Vero E6 cell culture.

Conclusion: Our findings suggest a potential mechanism wherein viruses exploit exosomes for pathogenesis, utilizing them to transport viral components for cell entry. While this phenomenon has been observed in numerous studies, further investigation is warranted to validate its occurrence in this experiment. This insight highlights the importance of elucidating the role of exosomes in viral pathogenesis.

P4: Determination of the role of TRP channels in intracellular Ca2+ signalling in Natural killer cells using live confocal imaging

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Introduction: Myalgic encephalomyelitis/chronic fatigue syndrome and post-COVID-19 condition are commonly associated with dysregulation of the immune system and unexplained fatigue. To explore the pathomechanisms involved in these diseases, confocal microscopy was used to examine changes in cellular processes and movement of ions across cells. Confocal microscopy is a specialised fluorescence technique broadly used to resolve detailed structures of specific objects within the cell. The high-resolution imaging technique is designed to increase optical resolution and contrast of an image by utilizing pinholes to eliminate out of focus light during image formation.

Method: In the present work, a confocal microscopy method was optimized and used to investigate various cellular processes monitoring the activity of different molecules in cells stained with different fluorophores. To monitor structural cellular components intracellular and intra-organelle calcium levels in real time, pharmacological activators and blockers were used to stimulate different cellular processes in live cells, using a gravity perfusion system.

Results: Changes in localization and colocalization of different molecules to specific cellular compartments and quantification of fluorescence intensity profiles was analysed using NIS-Elements and Origin software. Statistical significance ($p < 5$) among groups was determined using the independent t-test, and data presented as mean ± standard error of the mean (SEM).

Conclusion: The hypothesis that dysregulation of the immune system and unexplained fatigue in ME/CFS and post-COVID-19 condition is in part due to upstream dysregulations would be more reliable if differences in cellular responses between ME/CFS and post-COVID-19 condition compared to HC is significant ($p< 5$).

P5: Digital health interventions for post-operative recovery in children: a systematic review

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Background: Digital health interventions offer a promising approach for monitoring during post-operative recovery. However, the efficacy of these interventions remains poorly understood, especially in children. The objective of this study was to assess the efficacy of digital health interventions for post-operative recovery in children.

Method: A systematic review was conducted following the PRISMA guidelines, with the use of automation tools for searching and screening. We searched five electronic databases for randomised controlled trials or non-randomised studies of interventions that utilised digital health interventions to monitor post-operative recovery in children. The study quality was assessed using Cochrane Collaboration's Risk of Bias tools. The systematic review protocol was prospectively registered with PROSPERO (CRD42022351492).
Results: The review comprised 16 studies involving 2728 participants from six countries. Tonsillectomy was the most common surgery and smartphone apps (WeChat) were the most commonly used digital health interventions. Digital health interventions resulted in significant improvements in parental knowledge about the child's condition and satisfaction regarding perioperative instructions (SMD = 2.16, 95%CI 1.45, 2.87; z = 5.98, $p < 0.001$; $I2 = 88\%$). However, there was no significant effect on children's pain intensity (SMD = 0.09, 95%CI: − 0.95, 1.12; z = 0.16, p = 0.87; $I2 = 98\%$).

Conclusion: Digital health interventions hold promise for improving parental post-operative knowledge and satisfaction. However, more research is needed for child-centric interventions with validated outcome measures. Future work should focus development and testing of user-friendly digital apps and wearables to ease the healthcare burden and improve outcomes for children.

P6: The appeal of siRNA-Based Treatment for Merkel Cell Carcinoma: Present Understanding and Prospective Perspectives

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Merkel Cell Carcinoma (MCC) is an exceedingly rare and aggressive form of skin cancer, characterized by a paucity of treatment options. The cellular origin and etiology of MCC remain unclear, and there is ongoing debate regarding the potential roles of viruses and UV radiation in its pathogenesis. The efficacy of small interfering RNA (siRNA)-based therapies for enhancing treatment options for MCC is critically dependent on effective siRNA delivery. siRNA-based therapies that target viral genes in MCC cells have exhibited promising results. Lipid-based nanoparticles (LNPs) are an attractive option for siRNA delivery due to their unique properties, but several challenges must be addressed to optimize their potential. Therefore, we provide a comprehensive overview of the current state of knowledge regarding MCC, including its high rates of recurrence and limited treatment options. We also examine the potential of siRNA-based therapies for MCC, with a particular focus on the use of lipid-based nanoparticles as a delivery system.

P7: Altered Functional Connectivity in ME/CFS using 7 Tesla MRI

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Background: Myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) is a chronic condition of unknown aetiology. Studies have reported neurological disturbances such as cognitive impairment, and autonomic dysfunctions with altered functional connectivity (FC) in brain regions of ME/CFS patients. We hypothesized FC to be impaired in ME/CFS patients in the brainstem, cerebellum, salience (SA) and default mode network (DMN) regions of the brain.

Methods: 31 MECFS and 15 HC performed Stroop colour task on 7Tesl. 80 sagittal slices, 225 volumes fMRI data, using multiband EPI pulse sequence, repetition time (TR)=2000ms, echo time (TE)=22.4ms, flip angle=70o, multi-slice mode = Interleaved, acquisition matrix 192X192 and voxel size=1.25mm3 and T1-weighted data obtained using a Magnetization Prepared 2 Rapid Acquisition Gradient Echo Sequence (MP2RAGE) with TR=4,300ms, TE=2.45ms, first inversion time (TI1)=840ms, second inversion time (TI2)=2,370ms, first flip angle (FA1)=5o, second flip angle (FA2)=6o, and resolution=0.75mm3 with matrix size=256x300x320. MRI data was pre-processed using CONN toolbox's default pipeline. FC for 27 Regions of Interests (ROIs) in brain regions was computed.

Results: ROI-to-ROI analysis detected weaker FC between pontine nuclei and cerebellar vermis IX in ME/CFS patients (p=0.027).This pilot study reports compromised connectivity between pontine nucleus and cerebellum using 7T MRI suggesting cortical-ponto-cerebellar involvement consistent with ME/CFS symptomatology.

P8: Chemoenzymatic synthesis of cyclic ADP ribose derivatives as chemical probes for nucleotide binding proteins

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Chemical probes are important tools used in biological and biomedical research for a wide range of applications, such as imaging and visualization of biological structures, detection of specific molecules or biomarkers, and identification of protein-protein or protein-ligand interactions. Nicotinamide adenine dinucleotide (NAD+) is a ubiquitous cofactor in cellular metabolism, and it can be enzymatically cleaved into variants of ADP ribose to enable protein post-translational modifications (protein deacylation, mono-, and polyADP-ribosylation) and NAD+-dependent signalling processes. Cyclic ADP-ribose (cADPR), one of the key secondary messengers in calcium signalling, is produced from NAD+ by ADP-ribosyl cyclase (CD38 family). The newly discovered cADPR isomers 2'cADPR and 3'cADPR are produced by many bacterial and plant NAD+ cleaving enzymes as well as the neurodegenerative disease therapeutic target SARM1 in humans/animals. Our group has recently discovered novel variants of cADPR, namely 2'cADPR and 3'cADPR, and found 3'cADPR an activator of the Thoeris antiphage defence system in bacteria and a suppressor of plant immunity. However, the functions of 2'cADPR in bacteria and plants and the functions of both 2'cADPR and 3'cADPR in humans/animals are poorly understood. Here, we have designed and developed chemoenzymatic synthesis of C-8 modified NAD+, 2'cADPR and 3'cADPR analogues for further functionalization via Suzuki-Miyaura coupling or click chemistry. This will enable us to attach affinity handles to these analogues which can be used to identify novel protein interactions partners in plants, bacteria, and animals via proteomics.

P9: Screening virtual HDAC inhibitor libraries using QSAR in silico prediction models as a drug discovery tool for malaria

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Due to their crucial roles in the post-translational modification of eukaryotic proteins, lysine deacetylases (KDACs; also called histone deacetylases (HDACs)) are therapeutic targets for different diseases including cancers (where five HDAC inhibitors have been FDA approved for clinical use), inflammatory disorders, and some infectious diseases including malaria. By reversibly deacetylating lysine residues on histone and non-histone proteins, HDACs function together with lysine acetyltransferases to regulate gene expression and other critical cellular functions. While HDACs are potential drug targets in Plasmodium, the discovery of HDAC inhibitors as new drug leads for malaria has been constrained by 1) the need to perform time-consuming phenotypic screening assays against parasites due to the absence of recombinant forms of the three essential P. falciparum HDACs for enzyme or binding assays, and 2) the lack of robust in silico homology models of two of these three PfHDACs for virtual docking studies. To address this, in silico QSAR models have been recently developed within this laboratory as a tool to predict active versus non-active hydroxamate-based HDAC inhibitors based on their structures and physicochemical properties. These QSAR models incorporate P. falciparum in vitro activity data (50% inhibitory concentration; IC50) for ~400 hydroxamate-based HDAC inhibitors. In this presentation, data on the application of these QSAR models in screening large virtual combinatorial libraries of analogues (>200,000) of known HDAC inhibitors will be presented. The significance of using this new machine learning tool will allow for improved prioritisation of compounds and thus allow for earlier detection of hits for drug discovery of new antimalarials.

P10: Structural and biochemical characterization of an antiphage defence system in Bacillus subtilis

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Integrative and conjugative elements, or ICEs, are mobile genetic elements found in host bacterial chromosomes and typically carry cargo genes that benefit the host [1]. At least two such mobile genetic elements can be observed in certain strains of Bacillus subtilis – the integrative and conjugative element ICEBs1 [2,3], and the temperate phage SPß [4]. The spbK gene in ICEBs1 inhibits the production of active SPß. Its gene product, BsSPBK1, contains a TIR domain that is necessary for function [5]. TIR domains are found in plants, animals, archaea, and bacteria, and are known to show NADase activity [6]. This suggests that BsSPBK1 could also be an NADase effector, eliciting abortive infection that leads to cell death. The abortive infection depends on the SPß gene yonE, where co-expression of spbK and yonE inhibits the growth of host cells [5]. The exact function of yonE is not known yet. Its encoded protein, YonE, shares similarity with viral capsid portal proteins. Portal proteins are important components of many dsDNA viruses as they control genome packaging and capsid assembly [7]. They usually assemble as dodecamers and provide a channel for bidirectional passage of viral DNA.

The mechanism of how YonE and BsSPBK1 trigger an antiphage response is poorly understood. In this study, we have confirmed that BsSPBK1 has NADase activity and is modulated by YonE. A ~3.5Å cryoEM reconstruction of YonE suggests that the protein assembles into a dodecamer as expected for portal proteins. The EM density map fits well with the YonE dodecameric model predicted by AlphaFold2 [8]. AlphaFold2 was also used to model the N-terminal and TIR domains of BsSPBK1. We hypothesize that the N-terminal domain of BsSPBK1 mimics portal adaptor proteins and oligomerizes to form a dodecameric ring upon interaction with YonE [9]. The TIR domains self-assemble to form active sites capable of cleaving NAD+ [10]. A cryoEM structure of the YonE-BsSPBK1 complex will provide key mechanistic insights into how YonE interacts with BsSPBK1 to modulate its NADase activity. To this end, a stable complex of YonE and BsSPBK1 has been purified for cryoEM data acquisition.

P11: Haemostatic sponges for the emergency treatment of bleeding

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Uncontrolled bleeding in emergency medical care demands rapid intervention to prevent life-threatening complications, particularly in cases of deep, complex wounds causing uncompressible bleeding with severe organ damage. While conventional blood transfusion materials like allogeneic platelets and clotting factors are commonly used, they pose risks such as virus contamination, immune responses, and storage limitations. Haemostatic materials offer innovative solutions, and this study investigates the efficacy of chitosan sponges incorporated with nanoparticles as promising agents for emergency haemostasis, aiming to address the challenges associated with uncontrolled bleeding effectively.

The preparation of these sponges involves the incorporation of nanoparticles to enhance their haemostatic properties. To comprehensively assess the efficacy of these novel materials, we conduct a series of physical characterization experiments, encompassing water absorption tests, porosity analyses, mechanical strength evaluations, and scanning electron microscopy. These experiments provide invaluable insights into the structural integrity and mechanical properties of the sponges.

Furthermore, extensive in-vitro studies are conducted to delve deeper into key haemostatic parameters such as blood absorption, clotting time, haemolysis activity, and blood cell adhesion. The results of these studies reveal promising outcomes, highlighting the superior efficacy of nanoparticle-incorporated sponges compared to commercial sponges in controlling bleeding and promoting clot formation.

Building upon the positive findings of the in-vitro studies, our future research endeavours to advance to animal studies using a liver model experiment in mice. Through this experimental approach, we aim to further elucidate the haemostatic effect and clotting time of the nanoparticle-incorporated sponges, while also assessing sponge degradability and inflammatory reactions through in-vivo degradation studies.

Overall, this comprehensive research contributes to advancing our understanding of novel haemostatic materials and their potential application in critical emergency medical scenarios. Thus, our study sheds light on the potential of nanoparticle-embedded sponges to improve patient outcomes during severe haemorrhagic episodes by elucidating their effectiveness and performance metrics, offering a promising avenue for medical advancement.

P12: Novel polymeric nanoparticles to advance the treatment of atherosclerosis

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Cardiovascular disease (CVD) is one of the most prevalent causes of death not only in Australia, but throughout the whole world. The main cause for CVD is atherosclerosis. Despite causing millions of deaths each year, current treatments for atherosclerosis, primarily focused on managing risk factors, struggle to keep pace with the rising prevalence of the disease. This project explores a novel approach using biocompatible and biodegradable polymer, polysuccimide (PSI) to prepare nanoparticles for site-specific delivery of hydrophobic drugs. We use curcumin as the model drug for this project due to its natural atheroprotective effects, and we overcome the limitations of poor water solubility by preparing nanoformulations with this compound, potentially offering improved bioavailability and therapeutic efficacy. We further increase the efficacy of our nanoparticles by incorporating targeting ligands to the nanoparticle to achieve desired therapeutic effects at a lower dosage.

P13: Cardio-metabolic protection by inducible hyperbilirubinaemia

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Background: Individuals with Gilbert's syndrome (GS; UGT1A1*28 promoter mutation) are protected from major cardio-metabolic diseases such as obesity, diabetes, and cardiovascular diseases (CVDs) because of mild hyperbilirubinemia.

Aims: The purpose of this study was to: 1) Develop world's first inducible hyperbilirubinemia mouse model (homozygote (Cre-ERT2+/+) + (UGT1A1fl/fl)), 2) To determine the tamoxifen doses required to achieve circulating unconjugated bilirubin (UCB) concentrations of 5-16.9, 17-50, and 50-100 µM in UGT1A1fl/fl Cre-ERT2+/+ mice.

Methods: Eight groups of mice (n=6 per group; 3 male/3 female) at 6-8 weeks of age were used in the study. Mice were treated with daily intraperitoneal injections of tamoxifen (6 dose groups: 1X, 2X, 3X,4X, 5X and 6X mg/g body weight) in corn oil from day 1-5. Control received 100 µL/day corn oil. Animal body weights were monitored daily in addition to terminal organ weights from each group. On day 26, animals were sacrificed to collect blood and tissue samples for future UCB serum concentrations, qPCR, western blot, and histological analyses.

Results: Mean body weight of both male and female mice increased gradually for all doses over a period of 4 weeks. Serum UCB concentrations were greatest in the highest tamoxifen dosage group (>100µM), while lowest was observed in 2X mg/g body weight group (<10µM). Significantly lower serum concentrations were observed in male mice groups as compared to female mice groups. Greatest serum UCB concentrations (>120µM) were observed in female groups receiving 5X-6X mg/kg tamoxifen ($P<0.05$ versus control) at 19-26 days. The lowest tamoxifen dose (1X mg/g) failed to increase UCB in female mice, while 2X-3X mg/g tamoxifen induced the desired mid-level BR response (~17-50µM).

Conclusion: A dose dependent increase in serum UCB was confirmed in (Cre-ERT2+/+) + (UGT1A1fl/fl) mice administered with increasing tamoxifen doses. These data pave the way for studies to investigate the impact of increasing UCB on prevention and reversal of metabolic and cardiovascular diseases.

P14: Exploring the cellular roles of carbonic anhydrase III and finding new binding partners

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Carbonic anhydrases (CA) are a family of metalloenzymes that catalyse the reversible hydration of CO2, to form bicarbonate and a proton, contributing to pH homeostasis in the human body. CA3 is less well characterised among the 16 human CA isoforms, possibly due to its low catalytic activity minimising research interest, but unlike other CAs, it is reported to have surface-exposed cysteine residues and antioxidant activity. To better understand the cellular role of CA3, this project focuses on identifying and characterising binding partners and small molecule inhibitors for CA3, as well as exploring the role of the cysteine residues in CA3. We used a Halotag-CA3 fusion protein to pull down potential new binding partners, which will be identified using proteomic analysis. Native mass spectrometry screening of a compound library constructed with 993 mildly electrophilic fragments was used to identify potential CA3 inhibitors that target the surface exposed cysteine residues in CA3 rather than the normal catalytic site. A Nanobret assay, optimised to confirm binding between CA3 and previously reported binding partners, will be used to test the compounds acquired from the screening. This project will contribute to understanding the mechanism of CA3-protein binding in cells and how it is related to cancer development.

P15: Three-dimensional cell nerve bridges: a promising therapy for spinal cord injury

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Spinal cord injury (SCI) is devastating as it can cause permanent loss of motor, sensory and autonomic function. 21,000 Australians currently live with SCI and 300 new traumatic cases occur each year. Yet there are no commercially effective treatment options other than initial surgery to decompress and stabilise the injury site. The socioeconomic burden of SCI in Australia is also overwhelming. In 2020, the annual cost was $3.7bn and estimated lifetime cost was $75.4 billion. One potential therapy to repair SCI is the transplantation of olfactory ensheathing cells (OEC). OECs have numerous properties beneficial for repairing damage nerves. While OEC transplantation has previously been tested by other teams, the method needs improving. Our team has developed a three-dimensional (3D) cell bridge transplantation therapy that improves the function of OECs and enhances their engraftment into the injury site. Cells within the nerve bridges make stable intercellular connections prior to transplantation. After engraftment into the injury site, the cells quickly construct a permissive bridge over the injury site, which stimulate the spinal cord nerve cells to regenerate. This technology has the potential to make meaningful and significant changes to the community by being relevant to both new and chronic injuries.

P16: Circular RNA expression patterns associated with schizophrenia regulate cell adhesion and migration processes in patient-derived olfactory neuronal stem cell

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Non-coding RNAs (ncRNAs) have gained significant attention in recent years due to advancements in biotechnology, particularly high-throughput sequencing. These developments have led to new understanding in non-coding biology, revealing that majority of non-coding regions of our genome (~80%) possesses biochemical functionality. Circular RNAs (circRNAs), a type of ncRNA first identified in 1976, are highly stable, formed by back-splicing events, which generate covalently closed ends. CircRNAs are also evolutionary conserved, abundant in most human cell types and show high expression levels in the brain and exhibit varying degrees of biochemical functionality, such as their ability to sequester microRNAs (miRNAs) through sponging events. These miRNAs are short ncRNAs consisting of 19-23 nucleotides, which inhibit messenger RNA function and typically suppress protein expression as a result. In our research, we employed bioinformatic analysis to identify circRNAs in total RNA-sequencing data of schizophrenia-derived olfactory neuronal stem cells and determined expression differences between patient and control groups. We found overrepresented pathways among these differentially expressed circRNAs associated with cell adhesion and migration. We selected circRNAs from genes commonly linked to schizophrenia and these cellular processes, including circLMO7, circHAS2, and circZSWIM6 for further analysis and validation. Our continuing research aims to unravel functional roles of circRNAs and their contribution to schizophrenia pathophysiology.

P17: Chromatographic Fingerprint of Barringtonia acutangula Saponins

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The bark of Barringtonia acutangula has been used by traditional knowledge holders in the Kimberley region of Western Australia as a potent analgesic medicine for generations. The traditional knowledge holders in conjunction with researchers at Griffith University hope to develop this traditional medicine into an over-the-counter topical analgesic. Previous research has determined that the saponin content of the tree bark contributes to the analgesic effect. To meet regulatory requirements for marketing a traditional herbal medicine, a chromatographic “fingerprint” of these bioactive compounds is required. This presentation will outline the progress-to-date in developing a sensitive HPLC-MS fingerprint of the saponins from this plant

P18- Traditional Aboriginal Medicine- Development of An Indigenous Analgesic Topical

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The project aims to investigate the constituents and biomarkers for submission to the Australian regulatory systems related to Aboriginal and Torres Strait Islander Traditional Knowledge. Specifically, the project focuses on the mudjala plant (Barringtonia acutangula) used by the Nyikina people in the Kimberley region for the treatment of pain.

The PhD project aims to characterise the composition of the mudjala plant and its extracts. The project involves developing a quality control method for the medicine, with a focus on identifying biomarkers in the bark extract mixture. Once established, this method will compare biomarker levels across different sources and seasons, leading to cellular model testing to identify the most active compounds and their binding patterns with pain-related G protein-coupled receptors (GPCRs) and Ion Channels. Separation conditions for several aglycon type biomarkers have been established, resulting in the isolation of several pure compounds, with their structure elucidation currently in progress. These compounds could serve as valuable tools for further understanding the pharmacological mechanisms underlying traditional pain relief methods.

P19- Developing a Native Mass Spectrometry Platform to Investigate Ligand Interactions with Tuberculosis-Related Membrane Proteins

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This project proposes the utilization of extracellular vesicles as an innovative platform for identifying drug targets, particularly focusing on tuberculosis (TB)-related membrane proteins. Through native mass spectrometry (MS) techniques, it aims to elucidate the complex biological interactions at the membrane protein level, facilitating the identification of effective ligands for previously unidentified targets and discovering new ligands for membrane proteins with unknown binding partners.

The primary objective is to overcome the current limitations in membrane protein studies, which are hindered by the time-consuming selection of detergents. These detergents maintain known protein functions but may alter protein structure due to differences from native membrane lipids. By using extracellular vesicles as a model system, the project proposes a direct path to understanding the influence of the native lipid environment on membrane protein structure and function. This platform will significantly reduce the complexity and time associated with drug target identification, enabling rapid screening and discovery of new therapeutic targets and ligands. This could revolutionize our approach to combating TB and potentially other diseases by providing a more efficient and accurate method for identifying the molecular interactions essential for drug development.

P20- Label-Free Ligand Identification

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Tuberculosis (TB) remains a major global health threat, causing significant morbidity and mortality. The emergence of drug-resistant strains of Mycobacterium tuberculosis has further highlighted the urgent need for novel therapeutic targets and treatments. Targeting aminoacyl-tRNA synthetases, essential enzymes in protein synthesis, has emerged as a promising strategy for developing new anti-TB drugs. This project aims to investigate the feasibility of using collision-induced affinity selection mass spectrometry (CIAS-MS) for screening of tRNA synthetases as drug targets. Initially focusing on Leucyl-tRNA synthetase (LeuRS), CIAS-MS screening resulted for the identification of 24 compounds from a pool of 2000 candidates. Subsequent investigations into 20 of these compounds revealed 10 exhibiting inhibition on M. smegmatis assay and categorised into 6 distinct series. Notably, one series demonstrated enzyme inhibition under low ATP concentrations and have initialise the screening of analogues leading to a marine natural product with IC50 19 µM while the remaining series are under investigation via amino acid or tRNA competition assays. These findings demonstrate the value of CIAS-MS in identifying promising drug candidates for the development of novel anti-TB treatments.

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