ACUR | Australasian Council for Undergraduate Research

THE UNIVERSITY OF SYDNEY

12th Australasian Conference of Undergraduate Research

2—3 December 2024

Undergraduate Research in the Age of Adaptive Change and Artificial Intelligence

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Contents

Foreword

Angela Brew

It is with very great pleasure that I welcome you to this 12th Australasian Conference of Undergraduate Research. I am delighted this year to be able to welcome you onto the campus of Australia's oldest University.

As a multi-disciplinary conference, you will have the opportunity to meet other undergraduate researchers from your own and other disciplines. I'm confident that you will find the experience of presenting your research and hearing the varied presentations given by others exciting and stimulating. I hope that as well as attending sessions on topics allied to your own research, you will also take the opportunity to attend sessions on subjects that are unfamiliar to you. I know that you will gain much from meeting each other, developing research networks, and making new friends.

The theme of this years' conference is **Undergraduate Research in the Age of Adaptive Change and Artificial Intelligence.** This speaks to the work we are all having to do to be ready to continually adapt to changes in an uncertain and perplexing world. The now ubiquitous use of Generative AI is challenging us all to think hard about the nature of evidence. It is raising important questions about what is true, what the knowledge before us is and where it comes from. It highlights the importance of us all knowing how to engage with generating knowledge and participating in its development. In presenting research carried out by undergraduates in many different disciplines, this conference contributes to the ongoing conversations that people the world over are having in responding to these and other major challenges of our world.

Whether this is your first experience of an ACUR conference, or you are here for a second or third time, by presenting your research here you become a student member of ACUR for a whole year. So welcome to the conference, and welcome into to the ACUR Community!

Angela Brew

President ACUR

Welcome to The University of Sydney

Pauline Ross

Welcome to the University of Sydney! The Faculty of Science is delighted to host this year's conference on *Undergraduate Research in the Age of Adaptive Change and Artificial Intelligence*.

The theme for this conference, like many conferences worldwide, focuses on Artificial Intelligence – a topic that dominates discussions as we navigate its challenges and harness its opportunities.

When I asked AI to define itself – it replied:

> "I'm an AI language model created by OpenAI. My purpose is to assist, inform, and engage in a wide range of topics, from answering questions to providing creative ideas. I'm designed to adapt to your needs—whether it's for learning, brainstorming, or simply having a conversation. Let me know how I can help!!"

And when I asked whether AI what value does AI have in undergraduate research it replied

> "By integrating AI thoughtfully, undergraduate researchers can push the boundaries of what they can achieve, fostering innovation and skill development early in their academic careers."

We are excited about the rich discussions that await us at this year's conference. The overwhelming number of abstract submissions highlights a growing desire among students to connect with other students who share their interests and passions. We hope you enjoy the conference, make sure you say hello to those that you don't know and come along to the workshops and discussions we've carefully packed into this dynamic two-day event.

Pauline Ross

Conference Chair 2024

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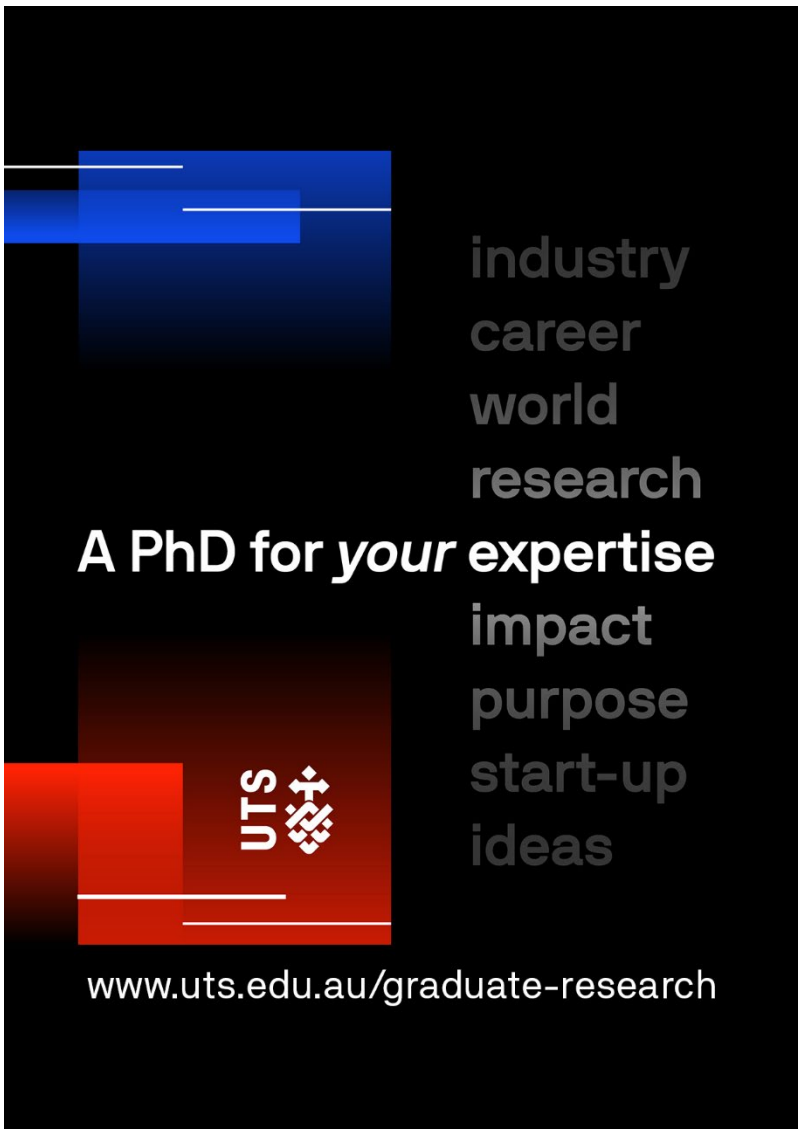


Program of events

Monday 2 December 2024

8:00	Arrival and registration	Foyer
8:50	Introduction and Acknowledgment of Country	Messel Lecture Theatre 4002 (Sydney Nanoscience Hub)
9:00	Opening Ceremony	
9:20	Keynote address – Prof. Susan Rowland	
10:00	Morning Tea and Poster Expo	Foyer
10:30	Oral presentations - Session 1	Medicine/Health - Messel Lecture Theatre 4002 Chemistry/Biology – LG17 – Physics Learning Hub Psychology - LG18 – Physics Learning Hub
12:15	Lunch and Poster Expo	Foyer
13:15	Oral presentations - Session 2	Psychology - Messel Lecture Theatre 4002 Physics/Mathematics – LG17 – Physics Learning Hub Technology - LG18 – Physics Learning Hub
3:00	Afternoon Tea and Poster Expo	Foyer
3:20	Workshop on Science Communication A/Prof. Alice Motion	Messel Lecture Theatre 4002
16:20	Oral presentations - Session 3	Medicine/Health - Messel Lecture Theatre 4002 Science/Environment – LG17 – Physics Learning Hub Arts/Media - LG18 – Physics Learning Hub
17:15	Conclusion	
17:30	Dinner	The Courtyard

Tuesday 3 December 2024

8:50	Welcome to Day 2 Keynote address – Prof. David James	Messel Lecture Theatre 4002
9:20	Panel Discussion – The role of AI in Undergraduate Research and Assessment	Messel Lecture Theatre 4002
10:00	Morning Tea and Poster Expo	Foyer
10:30	Oral presentations - Session 4	Medicine/Psychology - Messel Lecture Theatre 4002 Tech/Biology – LG17 – Physics Learning Hub Arts/Law - LG18 – Physics Learning Hub
12:00	Lunch and Poster Expo	Foyer
13:00	ACUR Annual General Meeting	Messel Lecture Theatre 4002
14:00	Oral presentations - Session 5	Psychology/Tech - Messel Lecture Theatre 4002 Education – LG17 – Physics Learning Hub Medicine/Health - LG18 – Physics Learning Hub
15:30	Poster Expo – Judging Afternoon Tea	Foyer
16:00	Closing Remarks Awards ACUR2025	Messel Lecture Theatre 4002
17:00	Close	

About the Conference

ACUR2024 will focus on the student experience of undergraduate research and its importance for addressing global challenges and shaping future careers.

The theme of this years' conference is **Undergraduate Research in the Age of Adaptive Change and Artificial Intelligence.**

The rise in the use of Artificial Intelligence has precipitated a pressing need to refocus on strengthening undergraduate students' research skills. Undergraduate research provides students with first-hand experience of the uncertainty inherent in the discovery of new knowledge. It equips them with the critical thinking skills required to navigate an Artificial Intelligence landscape where telling fact from fiction is becoming increasingly difficult. Research experiences build students' critical thinking and communication skills and strengthen their capacity to deal with the many challenges confronting contemporary society.

ACUR Organising Team

Professor Pauline Ross – The University of Sydney

Dr Dan Johnstone – Newcastle University

Dr Fran Van Den Berg – The University of Sydney

Dr Vicky Tzioumis – The University of Sydney

Emily Kerrison – The University of Sydney

Sara Wardak – The University of Sydney

Keynote Speakers

Professor Susan Rowland

Vice Provost, University of Sydney

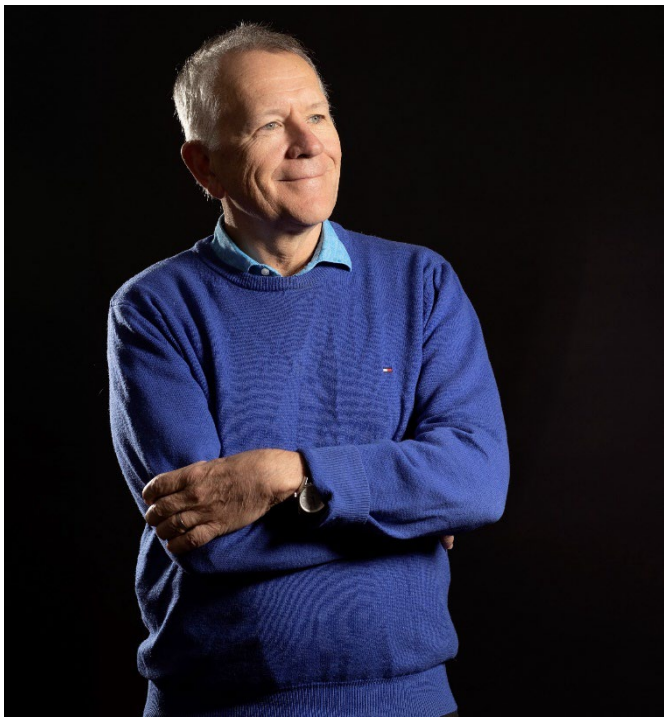
Professor Susan Rowland (BSc Hons PhD GCEd PFHEA she/her/hers) is an internationally recognised science educator. Her teaching and education leadership has been recognised with awards that include an AAUT Award for Teaching Excellence and Principal Fellowship of Advance HE.

Susan completed her BSc and PhD at the University of Sydney, and a postdoctoral fellowship at the University of Connecticut. She returned to Australia in 2006 to teach and research at the University of Queensland, building a leadership career as a Teaching Focused academic.

Susan became Vice-Provost at the University of Sydney in 2023. She is delegate for the Provost in key areas of academic management and operation. She oversees multiple enterprise-wide initiatives that support and enhance the academic business of the University. Her teams and areas of leadership include the University Libraries, SAGE (Science and Gender Equity), Gifts Administration, and Sustainability. Using an Adaptive Leadership approach Susan works closely with hundreds of staff stakeholders across the University to build and implement major programs of work.

Keynote Speakers continued

Professor David James – FAA, PhD



Professor James currently holds the Leonard Pullmann Chair in Molecular Systems Biology and he is the Domain Leader for Biology at the Charles Perkins Centre, University of Sydney. Professor James has made major contributions to our understanding of insulin action including the discovery of the insulin responsive glucose transporter GLUT4. He has won several awards including the Glaxo Wellcome Medal for Medical Research and he is a fellow of the Australian Academy of Science. His current work focusses on how genetics and the environment work together to control metabolic health and disease.

Workshop

Science Communication

Associate Professor Alice Motion

Alice Motion is Associate Professor and Deputy Head of School at the School of Chemistry, University of Sydney. Alice leads the Science Communication, Outreach, Participation and Education (SCOPE) Research Group. Alice's research and practice explores science democratisation through open source drug discovery, citizen science and creative methods for science communication. Alice was awarded the Eureka Prize for Promoting Public Understanding of Science in 2020. They have written a monthly column, *Citizen Chem*, for Chemistry World Magazine since 2018, are the creator of *Live From The Lab*, founder of the *Breaking Good* citizen science initiative and a regular guest on the ABC.

Panel Discussion

The role of AI in Undergraduate Research and Assessment

Pauline Ross (Facilitator)

Professor of Marine Ecology (PhD, Sydney) and Higher Education (PhD, Melbourne)

Professor Pauline Ross is the Director of Academic Leadership and Innovation in the Faculty of Science and immediate past Deputy Head of School of Life and Environmental Sciences at the University of Sydney, Australia. With over two decades of senior educational leadership experience at large and diverse metropolitan universities, Pauline focuses on developing contemporary curricula that provide meaningful experiences for students which are relevant beyond graduation and supporting the academics who teach them. She is known for her disciplinary and education research which encompasses the impacts of climate change and resilience of marine organisms in marine ecosystems, the importance of elevating Indigenous research and the evolving academic workforce in higher education. Pauline is one of Australia's most awarded academics, with multiple national and international awards for educational and teaching excellence and educational leadership.

Angela Brew

Angela Brew PhD is Emeritus Professor, Macquarie University, Sydney Australia. She is the Chair of the Australasian Council for Undergraduate Research (ACUR). She is an elected Fellow of the UK's Society for Research into Higher Education (SRHE), and a Life Member of the Higher Education Research and Development Society of Australasia (HERDSA). She was President of HERDSA from 1999-2003 and co-editor of the *International Journal for Academic Development* from 2000-2008. She holds degrees in philosophy, sociology and organisational development.

She has published eight books and over 250 refereed journal articles, book chapters, conference papers and reports. Her research is focused on the nature of research and its relation to teaching, learning and scholarship, models of research-led teaching and undergraduate research.

Adam Bridgeman

Adam is the Pro Vice-Chancellor (Educational Innovation). In this role, he leads work to provide professional development and collaborative support for teaching and learning activities across the institution. As an Australian National Teaching Fellow, Adam has dedicated his career to enhancing student learning and the student experience with an emphasis on the importance of the first year in shaping belonging, experience and outcomes. He has received numerous institutional and national teaching awards in the UK and Australia. Adam is leading the response to generative AI at the University of Sydney, covering aspects such as academic development, assessment redesign, policy reform, governance, the development of AI agents and partnering with students.

Ben Miller

Dr Benjamin Miller is a lecturer in English and Writing at the University of Sydney. His research explores responses to colonialism by Indigenous writers. He recently completed a secondment with Educational Innovation to develop and roll out support for redesigning assessment and teaching to connect with emerging Gen AI platforms. His research and his work with Gen AI focus on questions of bias, diversity, and critical thinking.

Sara Wardak

Sara is a 3rd year undergraduate student studying a Bachelor of Science and Bachelor of Laws at The University of Sydney, majoring in Genetics and Genomics. She works in the Faculty of Medicine and Health at USYD, where she is an Associate Investigator on an Australian Government Medical Research Future Fund Grant. Her research centres around public health particularly for adolescents and vulnerable communities, and codesign, with a focus on legal and policy implications.

Lilia Mantai

Lilia is a Senior Lecturer at The University of Sydney Business School and Academic Lead for Course Enhancement, where she currently oversees assurance of learning and guides curriculum development and assessment design. Her research concerns academic and researcher development, doctoral education, graduate skills and assessment. Lilia is a Senior Fellow AdvanceHE, Executive member of the Australasian Council for Undergraduate Research (ACUR), and Associate Editor for the Higher Education Research and Development (HERD) journal.

Session Chairs and Judges

James Brown
Thuy Dinh
Emily Kerrison
Reyne Pullen
Fran Van Den Berg
Rosie Cameron
Jacqueline Herbert
Osu Lilje
Pauline Ross
Michael Widjaja
Matthew Clemson
Dan Johnstone
Benjamin Miller
Reece Sophocleous
Kelsey Zimmermann

Prizes

Student prizes

Best Oral Presentation – Winner: **Minha Lee** (Western Sydney University)	sponsored by Western Sydney University
Best Oral Presentation – Runner-up: **Tommy Lu** (The University of Sydney)	sponsored by UTS
Best Poster Presentation – Winner: **Kendall Stead** (Macquarie University)	sponsored by UTS
Best Poster Presentation – People's Choice Award: **Asmitha Sivaneswaran** (Macquarie University)	sponsored by Western Sydney University
Best Paper in Education Research – Winner: **Claudia Bonaccorso** (Macquarie University)	sponsored by HERDSA

ACUR Medal

The *ACUR Undergraduate Research Medal* recognises a team or individual who has contributed outstandingly to undergraduate research in Australasia. This year the first ACUR medal will be presented at the close of the conference.

ACUR Medal 2024 Winner: Professor Kevin Brooks (Macquarie University)

ACUR2024 participants

Name and Institution

First Name	Last Name	Institution
April	Abela	Macquarie University
Liam	Andersson	University of the Sunshine Coast
Lachlan	Andrews	University of Queensland
Lily	Ballot Jones	Swinburne University of Technology
Amelia	Bevan	Macquarie University
Claudia	Bonaccorso	Macquarie University
Daniel Bruno	Bonatti	Western Sydney University
Noel	Caguicla	Swinburne University of Technology
Laetitia	Carlile-Purcarea	Macquarie University
Matthew	Catanzariti	The University of Sydney
Aaron	Chakerian	Macquarie University
Jamie	Chapman	Macquarie University
Ai Xin	Chew	University of Queensland
Eloise	Cicero	University of Queensland
Zachary	Cooper	Swinburne University of Technology
Marlowe	Crosdale	University of Queensland
Brandon	Crotty	Australian College of Applied Professions
Jemima	Davis	University of Queensland
Izzy	de Lorm	Macquarie University
Danielle	Dexter	University of New England
Anne	Dillon	University of New South Wales
Sara	Du	The University of Sydney
Katherine (Ngoc Bao Chau)	Duong	The University of Sydney
Megan	Eng	University of New South Wales
Natalie	Eula	The University of Sydney
Anna	Fioretti	Macquarie university
Elizabeth	Giblett	The University of Sydney
Luke	Glover	Macquarie University
Brooklyn	Gordon	Macquarie University
Jack	Gore	Swinburne University of Technology
Kiara	Gormlie	University of Notre Dame Australia
Natasha	Grant	Swinburne University of Technology
Jasmine	Gu	The University of Sydney
Daniella	Gullotta	University of Canberra
Samantha	Hamilton	Macquarie University
Azmain Ishrak	Haroon	Swinburne University of Technology
Riley	Hayward	Western Sydney University
Jack	Henwood	Swinburne University of Technology

First Name	Last Name	Institution
Lily	Hozeph	University of New South Wales
Guan-Jia	Huang	University of Queensland
Momo	Hudson Barton	The University of Sydney
Ishraf	Ismath	Swinburne University of Technology
Bianca	Jorgensen	Macquarie University
Amanda	Joyce	University of Technology Sydney
Agastya	Kapur	Macquarie University
Huzaifa	Khan	The University of Sydney
Edlyn	Kim	Macquarie University
Yoonji	Kim	University of New South Wales
Akito	Koike	The University of Sydney
Jianne	Lamadrid	University of the Sunshine Coast
Chloe	Langbein	Macquarie University
Flynn	Lauridsen	Macquarie University
Peter	Lavilles	The University of Sydney
Minha	Lee	Western Sydney University
Cormac	Lennon	Macquarie University
Denise	Lin	University of New South Wales
Yuqi (Richard)	Liu	University of Queensland
Jiayi	Lu	The University of Sydney
Tommy	Lu	The University of Sydney
Cen	Ma	The University of Sydney
Armansyah	Marpaung	University of New South Wales
Xiaobing	Mei	University of Queensland
Philip	Milosevski	University of the Sunshine Coast
Afnaan	Mohamad	University of Queensland
Alex	More	University of Notre Dame Australia
Stella	Morton	The University of Sydney
Todd	Neal	Swinburne University of Technology
Benjamin	Nguyen	Australian Catholic University
Elena	Ninkovic	University of Queensland
Le Quynh Trang	Pham	Macquarie University
Arda	Poda	The University of Sydney
David	Prego	University of Canberra
Jordan	Ratcliffe	Macquarie University
Tabish Ali	Rather	Swinburne University of Technology
Nanayakkara	Ridmee	Macquarie University
Sharlene	Robbins	Macquarie University
Danny	Saadeh	Western Sydney University
Madhura	Sabanayagam	Macquarie University
Sigrid	Seage	Macquarie University
Aaliya	Shakoor	Western Sydney University

First Name	Last Name	Institution
Mani	Shayestehfar	The University of Sydney
Qijie	Shen	Edith Cowan University
Tian Yi (Amy)	Shi	The University of Sydney
Aniket	Sinha	The University of Sydney
Asmitha	Sivaneswaran	Macquarie University
Rakshaaiyan	Somasundaram	Macquarie University
Daniel	Somerville	Macquarie University
Kendall	Stead	Macquarie University
Angus	Stewart	Macquarie University
Graham	Stoney	The University of Sydney
Anastasia	Stuart	Macquarie University
Dora	Szabo	Macquarie University
Ayako	Takahashi	University of Queensland
Jia	Thadani	Western Sydney University
Gabriella	Tiernan	Australian College of Applied Psychology
Vivian	Toh	University of Queensland
Dang Huy (Andrew)	Tran	Swinburne University of Technology
Jade	Upton	University of Queensland
Jaime	Vanek	Swinburne University of Technology
Matthew	Vassilieff	Macquarie University
Premjai	Vongvises	The University of Sydney
Abbey	Waddington	University of Queensland
Patrick	Wang	University of Queensland
Sara	Wardak	The University of Sydney
Zoe	Warland	University of New South Wales
Lily	Wells	Macquarie university
Tony (Jingbo)	Wen	The University of Sydney
Jaden	White	The University of Sydney
Nathan	Wise	Western Sydney University
Valerie	Wong	University of Queensland
Fiona	Wylie	Macquarie University
Jinyang	Yang	University of Queensland
Bailey	Yoshia	Macquarie University
Diane	Young	University of Queensland
Yimei	Zhao	University of Queensland
Yaxin	Zheng	Australian National University
Kevin	Zou	University of New South Wales

Conference Proceedings

ORAL presentations

Liam L. Andersson, School of Health, University of the Sunshine Coast; Sophie C. Andrews, Thomas Pace Thompson Institute, University of the Sunshine Coast

Examining the Influence of Subjective Cognitive Decline and Educational Attainment on Dementia Risk Assessment

Digital healthcare innovations, such as AI-driven screening tools, are transforming how we assess dementia risk, producing opportunities to integrate novel predictive measures. Whilst subjective cognitive decline has been identified as a potential indicator of later dementia, its relationship with dementia risk assessment remains unclear.

Here, we cross-sectionally examined the association between subjective cognitive decline and dementia risk in a sample of 86 Community-dwelling Australian older adults from the LEISURE study. Participants completed measures of subjective cognitive decline (BC-CCI) and cognitive dementia risk (CogDRisk). While initial bivariate correlations revealed no relationship between subjective decline and dementia risk (r = .094, p = .387), hierarchical regression analysis revealed significant results. When controlling for age and gender, higher subjective cognitive decline significantly predicted higher dementia risk scores (β = .18, p = .008). Interestingly, when education was added to the model, the relationship between subjective cognitive decline and dementia risk, while still significant, was attenuated, with less variance explained (β = .13; p = .050).

These findings suggest educational background plays an influential role in the relationship between subjective cognitive decline and dementia risk. Theoretically, it extends our understanding of how educational attainment shapes the relationship between subjective cognitive reports and dementia risk measures. Practically, it suggests that while brief self-report measures of cognitive decline may enhance innovative screening algorithms, educational background must be accounted for to provide accurate risk assessments

Lachlan Andrews, Anna-Bella Ludwigsen, Kylie Tucker, School of Biomedical Sciences, Faculty of Medicine, The University of Queensland

Quantifying Vertebral Morphology Asymmetries in Adolescent Idiopathic Scoliosis: A Case-Control Study

Adolescent Idiopathic Scoliosis (AIS) describes an atypical three-dimensional spinal curvature characterised by rotation, wedging and translation of multiple vertebrae. AIS progression is associated with lateral vertebral body and intervertebral disc wedging, anterior vertebral overgrowth and asymmetrical pedicle formation. Recent data provides evidence of an interaction between asymmetrical paraspinal muscle and vertebral bone formation in AIS that aligns with the influence of muscle forces on bone growth.

However, current research is limited by two-dimensional assessments of vertebral morphology which do not encompass three-dimensional spinal curvature. Further, no previous studies have considered muscle and vertebral formation in the same AIS participants.

2D and 3D vertebral morphology outcomes were determined from semi-automatically reconstructed MRI's using ITK-SNAP of n=7 adolescents with right-primary-thoracic AIS (female; years; thoracic Cobb angle:) and n=6 adolescents with typically developing spines (female; years).

Our results demonstrate that, compared to those with typically developing spines, vertebral body and intervertebral disc wedging were more asymmetric at apical (most laterally shifted) vertebrae of thoracic and lumbar curves in AIS (all $p<0.05$); and multifidus-vertebra attachment angle was more asymmetric at lower end vertebrae (most tilted vertebra below apex) of the thoracic curve ($p<0.001$). Intraclass correlation coefficients indicated excellent reliability [ICC > 0.9] for direct measurements and moderate reliability [ICC > 0.50] of asymmetry indices.

Our next steps are to complete these measures on data obtained from larger AIS and control cohorts and combine muscle and bone outcomes from this population to provide new insights into musculoskeletal interactions involved in AIS progression.

Lily Ballot Jones, School of Social Sciences, Media, Film, and Education, Department of Humanities and Social Sciences, Swinburne University of Technology

Secret Silicon Snowballs: Limitations of Artificial Intelligence Regulation

The nature of AI means that we will need to live in the world in a fundamentally new way, and this has significant implications for regulation. The global context of AI raises the question of how effective regulation can occur? This research presents a discourse analysis of current approaches to AI regulation in multiple jurisdictions internationally, seeking to map the interconnectedness of impacts associated with the technology. Antonio Gramsci's theory of hegemony and Jacque Ellul's theory of technique inform the analysis of this mapping. In applying these theories this research comes to understand the dominant forces involved in creating this world-changing technology, and the rationale behind its rapid and potentially destructive development. Complex societal issues emerge from this approach, illuminating underrepresented connections AI systems have with the attention economy, our information society, and US anti-trust legislation.

The findings of this research indicate a general lack of awareness of the interconnected, pervasive, and on-going effect of AI technologies. Discrete risks arising from the operation of AI systems themselves, associated primarily with bad-actor applications, are the current focus of most AI regulatory approaches. While this risk-based regulatory approach has an important place in our current landscape, particularly for business, it does little to accurately capture the cumulative impacts of AI that are borne out of its increasing ubiquity. The research concludes with recommendations on possibilities for reframing our collective understanding of AI to guide effective regulation.

Claudia Bonaccorso, School of Psychological Sciences, Faculty of Medicine, Health and Human Sciences, Macquarie University

Educator Gesture Use and Infant-Educator Conversational Balance in Australian Long-Day Care Centres

Within the first 3 years of life, infants undergo rapid increases in language development and are highly sensitive to their interactions with their caregivers. Whilst existing research has focused on caregivers' facilitation of infants' independent language acquisition, the current study focused on dyadic forms of communication, namely, conversational balance, which is the extent to which interpersonal interactions have mutual verbal and non-verbal contribution from all parties involved. Conversational balance is essential for infants' acquisition of conversational turn-taking, which assists infants' later brain maturity and communicative skills. Research on infants' conversational ability has primarily focused on mothers' vocal input and how this can facilitate infants' contribution to conversations, ignoring gestural components and the influence of early childhood educators. The present study investigated whether the quantity of educators' gestural input might be associated with vocal and gestural conversational balance between 12–21-month-old infants and their educators.

Data were obtained from long-day care centre visits to 188 infants in the Sydney metropolitan area, whereby 90-minute-long video-camera recordings were taken of these infants interacting with their educators. Conversational balance between infants and educators and the quantity of educators' beat, metaphoric, deictic, iconic and emblematic gestures were coded.

Findings suggest that educators' gesture use can facilitate infants' mutual contribution to conversations. Specifically, educators' deictic and iconic gestures were associated with more balanced infant-educator conversations. These findings support the critical role of early childhood educators in infants' development of language skills, such as conversational balance, and further reinforce the vital contribution of gestures to language development.

Laetitia E. Carlile-Purcarea, School of Psychological Sciences, Faculty of Medicine, Health and Human Sciences, Macquarie University

Predicting Aggression from Problematic Screen Use: The Roles of Gender and Neurodiversity

Background and aims: Given the omnipresence of screen use in today's digital society, it is vital to understand the effects of screen use on behaviour and cognition. This study examines how different types of problematic screen use (PSU) impact various facets of aggression and whether these relationships are moderated by gender, autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD).

Method: 1,440 participants completed an online questionnaire which measured PSU across five media formats—smartphones, reeling (watching short-form videos, such as TikTok's), social media, gaming and the internet—alongside measures of trait hostility, anger, verbal and physical aggression, and recent hostility, cyberaggression, and verbal, physical, indirect and relational aggression.

Results: PSU significantly predicted all forms of aggression, with distinct relationships between specific media formats and most aggression subtypes. Gaming was the most widely applicable independent predictor of aggression, followed by the internet and smartphone use, and reeling. Gender moderated several of these relationships. Males exhibited steeper increases in trait physical aggression, recent hostility, indirect aggression and cyberaggression as a function of problematic social media use, whereas females showed a stronger association between problematic gaming and physical aggression. Neither ASD nor ADHD significantly moderated any of the relationships between PSU and aggression.

Conclusion and future research: These findings demonstrate different media formats uniquely affect various types of aggression and highlight the moderating role of gender. Future research should explore these relationships further—in particular, regarding the applicability of these findings to non- binary individuals.

Aaron N. Chakerian, School of Computing, Faculty of Science, Macquarie University

AI in the Feedback Process of Undergraduate Thesis Writing: Benefits and Limitations

Research Question: This study conducts a scoping review to examine "the benefits and limitations of using AI as a feedback mechanism in undergraduate thesis writing". Aligned with the theme of "Undergraduate Research in the Age of Adaptive Change and Artificial Intelligence," the research explores how AI-driven feedback can transform the thesis writing process by providing personalised and timely support.

Contextualisation within the Theme: As AI becomes more integrated into higher education, its role in delivering adaptive feedback has become increasingly relevant. AI tools offer customised guidance that evolves with student progress, potentially enhancing engagement and improving writing outcomes. However, while AI excels in providing feedback on language, structure, and coherence, its ability to foster deeper learning and self-directed refinement requires further exploration.

Background Information: AI-based feedback systems offer real-time suggestions that can streamline the thesis revision process, making them increasingly significant in academic settings. Understanding how AI influences students' writing and revision practices is essential to gauge its effectiveness as an adaptive learning tool, particularly as students face complex academic demands.

Research Methodology: This scoping study synthesises a broad range of literature on AI's role in the feedback process, identifying key themes and gaps in current research. Through this examination, the study seeks to clarify AI's potential to enhance writing precision and efficiency, while also considering the areas where AI's impact on critical thinking and comprehensive feedback. The findings are anticipated to offer insights into both the strengths and potential challenges of AI-driven feedback in academic writing and research.

Jamie Chapman, Lynlee Howard-Payne, Mia Underwood, School of Psychological Sciences, Macquarie University

"The Future Weighs on me": An IPA of the Lived Experience of Typically Developing Siblings of Individuals with Neurodevelopmental Disability

Typically developing (TD) siblings of individuals with neurodevelopmental disabilities (ND) face unique concerns regarding the future care of their siblings, especially as parental capacities decline with age. Despite the regular use of external disability support services, TD siblings often have limited information or involvement in these supports, which complicates their ability to plan and adapt to future caregiving roles. Using interpretative phenomenological analysis (IPA) within a critical realist framework, this study explored the lived experiences of eight adult TD siblings.

The IPA approach allowed for in-depth exploration of how these siblings make sense of their caregiving responsibilities and the adaptive strategies they use. Semi-structured individual interviews revealed that TD siblings frequently develop negative attitudes towards external support services. These attitudes are shaped by media portrayals, prior negative experiences, and parental influence, with those in rural areas facing additional challenges due to limited service availability.

Our findings highlight the adaptive challenges TD siblings encounter as they navigate the complexities of caregiving roles within a changing support landscape. Without adequate information and involvement, TD siblings struggle to critically assess the effectiveness of external services, which exacerbates their anxiety about future caregiving responsibilities. This suggests that societal structures, such as disability services, either facilitate or hinder TD siblings' ability to adapt to their future caregiving roles. To facilitate adaptive change, we recommend increased transparency in service quality, inclusive decision-making processes that involve TD siblings, and better communication about available supports. These changes could help mitigate negative perceptions, reduce anxiety, and better prepare TD siblings for their evolving caregiving responsibilities.

Ajay Kevat, Department of Respiratory and Sleep Medicine, Queensland Children's Hospital; The University of Queensland; Dhruv Alwadhi, **Ai Xin Chew**, The University of Queensland; Dr Kartik Iyer, The University of Queensland, QIMR Berghofer Medical Research Institute, Queensland; Jasneek Chawla, A/Prof Sadasivam Suresh, Andrew Collaro, Department of Respiratory and Sleep Medicine, Queensland Children's Hospital; The University of Queensland

Positional obstructive sleep apnoea

Positional obstructive sleep apnoea, in which there is a ≥2:1 predominance of obstructive events in the supine position, is a sleep-disordered breathing phenotype with a targeted treatment in the form of positional device therapy. We sought to determine the prevalence of positional obstructive sleep apnoea in a cohort of children prescribed continuous positive airway pressure therapy, ascertain risk factors for the condition, and determine the associated continuous positive airway pressure treatment adherence rate.

A retrospective cohort study of all children >2 years old from a single tertiary paediatric centre prescribed continuous positive airway pressure therapy over an eight-year period was conducted. Positional obstructive sleep apnoea prevalence was established by analysing positional and respiratory event data from the participants' original diagnostic polysomnography. Continuous positive airway pressure therapy adherence was determined using data from machine download. Univariable and multivariable logistic regression modelling was used to determine participant demographic and clinical factors associated with positional obstruction.

Positional obstructive sleep apnoea (defined by Bignold's criteria modified for paediatric use) prevalence in the cohort of 237 analysed participants was 38%. Suboptimal continuous positive airway pressure adherence was noted in 30% of this group based on initial machine download, performed median 96 days post-treatment initiation. Higher age and lower obstructive apnoea hypopnea index were independent predictors of positional obstructive sleep apnoea, whereas neurodevelopmental diagnosis, presence/absence of rapid eye movement-related obstructive sleep apnoea, overweight/obesity status and history of adenoidectomy/adenotonsillectomy were not. For children, positional device therapy is a treatment option worthy of further consideration and research.

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Social Media as Cultural Artefact: Examining Museum Collection Practices in the Digital Age

Background and aims: When we're gone, how will our stories be commemorated? How can we conceptualise social media as collectible artefact? How can we identify what is culturally and historically significant, and what are the actual mechanisms and protocols of collection? Eloise Cicero, Katie Humphries and Dr Caroline Wilson-Barnao of the University of Queensland, and Craig Middleton of the National Museum of Australia, worked together over summer 2023-2024 to investigate the galleries, libraries, archives and museums (GLAM) sector's approach to curating social media as cultural artefact.

Method/process: The student partners (Eloise and Katie) collated case studies of museum social media artefacts and collection policies and spoke with cultural institutions across the globe about their practice within this space.

Results/findings: The results are still a work in progress. However, the student partners found sparse case studies of social media collected in institutions for exhibitions, but a distinct lack of clear policy and consistent social media curation across multiple geographic locations. The Arab American National Museum, for example, engaged with the Internet Archive to collect social media posts for one specific collection. However, they acknowledged that they did not have the resources to continue.

Conclusion/implications/directions for future research: This project is still ongoing, and both Dr Caroline Wilson-Barnao and Craig Middleton are continuing to investigate the GLAM sector's investment in social media collection and curation for future generations.

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Green Energy from Ground Bugs

Background and aims: Microbial Fuel Cells are an emerging technology in development to meet bioremediation, water purification, energy purification and industrial detoxification needs. They function by leveraging the electroactive character of particular microbes to generate electricity through the degradation of specific substrates. A suspected *Chryseobacterium* was isolated in 2023 which may possess electroactive traits. An honours project was undertaken to characterise this isolate and assess its capability to "drive" energy generation in a practical single-chamber MFC.

Method/process: The isolate was characterised by first determining effectual growth media, and then by biochemical testing (Microbact, methylene blue reduction assay, and the KOH test). Subsequently, its MFC compatibility was evaluated through iterative MFC design exploring liquid paraffin overlay as a means of inducing anaerobic conditions, and potassium ferricyanide as a cathodic electron acceptor, measured by cyclic voltammetry. BLAST searches and phylogenetic tree analysis were used to reaffirm the isolate's identity.

Results/findings: The isolate could be grown comparably in Tryptone Soya, Luria, or Mueller-Hinton media with or without oxygen. Microbact failed to identify the isolate but provided insights into its biochemical preferences. The KOH test returned a positive result in support of a *Chryseobacterium* identity, while successful methylene blue reduction supported possible electroactive traits. No electroactivity was measured aerobically, nor significant electroactivity anaerobically. Bioinformatics failed to generate a positive identity, but phylogenetic tree analysis of nearest BLAST matches enabled an indication towards a *Chryseobacterium* identity to be established.

Conclusion/implications/directions for future research: The isolate is likely a *Chryseobacterium* possessing comparably unique biochemical preferences to other Chryseobacteria and showing potential via the methylene blue reduction assay towards electroactive behaviour. MFC experiments were unable to measure significant electroactive behaviour, though only one potassium ferricyanide was trialled. Exploration of other cathodic electron acceptors besides potassium ferricyanide and generating a definitive identity for the isolate present viable future directions.

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How Depictions of Death and Negativity Impact Meaningful Media Choice

Research attempting to predict healthy media use has proposed a distinction between meaningful and pleasurable media. Though useful, it remains unclear what may motivate someone to seek meaningful media. Terror management theory may account for this, proposing that depictions of death motivate people to search for meaning. This study investigated whether terror management effects may underly the motivation to consume meaningful media.

A convenience sample of 97 Australians participated in an experiment with three groups, and were shown media either related to death, negativity, or of neutral content. After participants completed the Eudaimonic and Hedonic Media Motivations Scale and Third-Person Perceptions Scale, they were given a choice to watch either a meaningful or pleasurable YouTube video. Their choice was recorded, and the frequency of meaningful or pleasurable choices between groups was analysed in a chi-square test of homogeneity. No significant differences were found between groups, however a t-test revealed that the negative media group chose significantly more hedonic media compared to the other two groups.

These results suggest that participants may have been desensitised to depictions of death in media, limiting terror management effects and encouraging the use of alternative protocols in future study. Additionally, the higher frequency of pleasurable media choices in the negative group suggests people may seek comforting or pleasurable media to alleviate negative moods.

Keywords: eudaimonic media, hedonic media, terror management theory, mood management theory

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Tipping the Scales: The Effects of Performance Monitoring and Metrics on Burnout, and the Role of Procedural Justice and Feedback Favourability

While performance monitoring and metrics processes are central to the effectiveness of modern organisations, there are growing concerns regarding potential harms to employee well-being associated with these systems. These harms may be exacerbated by the rapid advancement of digital technology, which allows for unprecedented employee monitoring. The impact of metrics-based systems on employee burnout is uncertain. To improve understanding of the relationship between performance monitoring and metrics use and burnout, as well as potential boundary conditions, the current study used a two-wave survey design with a final sample of N = 341 full-time working employees in the United Kingdom.

As hypothesised, employee burnout was highest when procedural justice in the metricisation process was low, employees' performance on metrics was highly linked to rewards, and employees were monitored to a high degree. However, no direct relationship was otherwise found between performance monitoring and metrics and burnout. Therefore, this focal relationship emerged only under certain conditions. In addition, while it was predicted that metrics use in performance appraisals would affect the performance monitoring and metrics-burnout relationship, no influence of this variable was observed in the moderation analyses. Nor did feedback favourability interact with metrics use in performance appraisals to affect metrics-related burnout as predicted. However, these null results may reflect sample characteristics and methodological issues rather than indicate that these variables pose no risk of contributing to burnout.

The study results demonstrate that metrics-related burnout is highly nuanced. To potentially mitigate burnout, it is advised that organisations ensure that their metricised reward allocation systems are perceived as procedurally just. To build upon these findings, future research may utilise more robust measures of feedback and investigate a sample where there is greater variability in the range of feedback given to staff.

Keywords: employee monitoring, procedural justice, feedback, burnout

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Digitally Connected? Exploring whether negative social comparison and gratitude influence the relationship between social media use and loneliness

This study examined factors that moderate the relationship between social media use frequency and loneliness among young adults, while controlling for depression and anxiety. We hypothesized that this relationship would become (a) more positive as upward comparison increased and (b) more negative as gratitude increased. To test these hypotheses, we conducted a cross-sectional survey of 254 young adults aged 18 to 25 years. Contrary to expectations, neither upward comparison ($\beta = .08$, $p = .245$) nor gratitude ($\beta = -.04$, $p = .579$) moderated the relationship between social media use and loneliness. Additionally, social media use was not significantly related to loneliness ($\beta = -.07$, $p = .313$). However, loneliness was positively associated with upward comparison ($\beta = .15$, $p = .012$) and negatively associated with gratitude ($\beta = -.18$, $p = .011$), suggesting that individuals who make frequent negative comparisons on social media are at a higher risk of loneliness, while more grateful individuals are at a lower risk. These results suggest that dispositional differences in gratitude between individuals, as well as qualitative differences in social media engagement related to negative social comparisons, are more relevant to users' sense of connectedness than how frequently they use social media use. Thus, interventions which enhance gratitude and minimize negative social comparisons may help to combat rising rates of loneliness among young people.

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The Regeneration of an Australian Shrubby Woodland After Low and High Severity Fire: Design Implications for Conservative Land Management

Understanding the impacts of fire upon the composition and structure of plant communities assists in developing conservation-focused management practices. Many Australian plant species demonstrate persistence and reproductive strategies in response to fire, such as resprouting and seedling recruitment, which can vary in success depending upon the fire's intensity, frequency and season. This study investigated the impact of fire and fire severity on the vegetation composition of a semi-arid Australian woodland, considering plant life forms and fire survival strategies. Nested quadrats were sampled within Pilliga East State Forest to determine the richness, abundance and diversity of vascular plants, with sampling locations in unburnt, low severity and high severity burnt areas. Data was analysed using principal component analysis, generalised linear models and analysis of variance which demonstrated differences in floristic composition between the treatment groups, without significant differences in overall measures of biodiversity. Similarities between the low and high severity burnt plots were detected, including a greater abundance of forbs compared to the unburnt plots, suggesting the evolutionary adaptations of the community to wildfire. With climate change and other anthropogenic factors altering fire regimes, these preliminary results discovered through undergraduate research can assist in designing fire management approaches that support the vegetation within Pilliga East. The results also prompt further research into individual species with a currently unknown, yet strongly indicated, fire response.

Keywords: Biodiversity, climate change, fire regime, fire strategy, Pilliga, vegetation

Anne Dillon, Faculty of Medicine, University of New South Wales

Assistants, Friends, and Lovers: Psychological Responses to AI

Humans have a tendency to categorise anything with social presence, including technology, by gender. The ubiquity of voice-based technologies and the decreasing age of its users mean that an increasing proportion of human communication occurs with or through technology, and that software developers have an emerging responsibility to consider how their design choices are interpreted.

An online experiment was conducted on an international convenience sample of participants aged 18-73 recruited through social media (N=250). We aimed to assess the effects of vocal femininity/masculinity on perception of stereotypically masculine and feminine traits for the 'jobs' of Assistant, Friend, and Lover. We also examined whether any effect of vocal masculinity/femininity interacted with the AI's 'job' to affect participants' perceptions of the AI's traits.

In contrast with existing literature, our study found no significant main effect of vocal gender on any of our dependent variables. Context of use significantly affected the technology's usefulness and femininity, with Lovers being least useful and least warm. Additionally, the Assistant voice showed an increase in perceived warmth and communality in association with pitch, while the Friend voice demonstrated the opposite. Neither gender nor job affected ratings of masculinity or the extent to which the participants reported anthropomorphising the AI.

Our findings challenge the common corporate declaration that female-voiced devices are a universal preference, demonstrating that responses to technology may be more strongly influenced by social context than vocal gender. Future software development and machine learning research should focus on technological features specific to context of use.

Sara Du, School of Medical Science, Faculty of Science, The University of Sydney

Walk In Their Shoes: Inspiring Indigenous Students into Healthcare Careers through Immersive 360-Degree Video Technology

Indigenous Australians are significantly underrepresented in healthcare, comprising only 1.7% of the workforce. This contributes to cultural unsafety and delayed healthcare access, with 70% of Indigenous deaths potentially avoidable through timely care. Limited visibility of career pathways leads many Indigenous students to have lower aspirations and gravitate toward lower-skill jobs. This pilot study explores the effectiveness of an immersive 360-degree video in engaging Indigenous students with healthcare careers.

The interactive video follows a day in the life of a radiographer, a field with particularly low Indigenous representation. It was tested with 24 Indigenous high school students in the *Baribunmanyi Wangi Ngay* program, which introduces youth to healthcare pathways. Focus group discussions showed 83% of students found the resource engaging and informative. Career advisors noted the value of such tools in introducing roles students might not otherwise consider. Both students and advisors expressed interest in expanding the resource to other fields like nursing.

These findings highlight how culturally relevant, immersive tools can inspire Indigenous students to explore healthcare careers, empowering them to make informed academic choices. This will improve health outcomes for Indigenous communities and support long term pathways out of poverty through higher education, fostering both individual and community empowerment from the roots.

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Understanding Tubulin Variants in Malformations of Cortical Development

Microtubules are structural components of cells, made up of heterodimers consisting of α- and β-tubulin, and this structure plays a significant role in various cellular processes, including cortical development. Disruptions to this process, caused by sequence variants in tubulin genes, result in malformations of cortical development, or MCD. This leads to intellectual disability, continual seizures and often early childhood death. Despite the discovery of a large number of variants within multiple tubulin isotypes, the underlying mechanism is not yet fully understood. *In vitro* and *in vivo* studies can provide in-depth examination on how tubulin variants work; however, they are time-consuming and cannot accommodate the rate of gene-variant discovery. Consequently, the focus of this study aims to predict the molecular effects of tubulin variants based on *in silico* structural changes using *in silico* analysis of tubulin 3D models.

The study included 3 variants found in *TUBA1A*, 2 in *TUBB3*, and 1 in *TUBB2B*, representing common tubulin genes associated with MCD. We found that variants localized at microtubules outer surface are more likely to affect the localization and interactions of microtubule-associated proteins (MAPs), whilst those located at the interfaces between heterodimers tend to impact microtubules dynamics and kinetics. Future works will expand the *in silico* and functional analysis with the aim of establishing a correlation between tubulin gene variants and their molecular consequences on MCD. This can further enhance our understanding of this neurodevelopment disorders by variant/mechanism correlations that will inform the approach towards new interventions and treatment pathways.

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Is Your Phone Distracting You? The Effect of Phone-like Vibration Interruptions on Sustained Attention in a Dynamic Task.

Background and aims: Despite the many benefits of smartphones, they also frequently interrupt us. Previous behavioural research shows that interruptions produce costs on performance, and that the mere presence of a smartphone may be distracting enough to produce similar effects. However, few studies have tested this with dynamic tasks which may better model crucial aspects of real-world scenarios, such as driving.

Method/process: In this pre-registered study, we examined the effect of phone presence, and a phone-like vibration, on performance in a dynamic task, the Multiple Object Monitoring (MOM) paradigm. In this task, dots move along visible trajectories towards a central obstacle. In the Active MOM, used here, 50% of dots in a relevant colour deflect automatically, but 50% continue towards a collision and must be manually deflected using a button press. In a within-subjects experimental design (N=30), participants completed ~28 minutes of the MOM task under two conditions: with their phone visible and a notepad (control) condition. Within the phone condition, half of the blocks included phone-like vibrations.

Results/findings: Measures of accuracy and reaction times showed that there was no overall effect of phone presence, nor interruption, using Bayesian analyses. Eye tracking measures, however, showed that participants looked at the phone location more often than the notepad.

Conclusion/implications/directions for future research: This suggests that the vibration captured attention, but MOM task performance is not sensitive to transient attention shifts. Funding ARC Future Fellowship to ANR (FT230100119).

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Proteomics as an Alternative to Genomics in Melanoma Diagnosis

Background: Melanomas that cannot be diagnosed using clinical and histological assessment may benefit from genetic mutation testing. Diagnosis of melanoma through identifying mutated proteins is a possible alternative method that may overcome obstacles related to genetic testing, such as costs. However, the feasibility of this approach has not been tested in melanoma. Therefore, this study investigates the ability to identify mutated proteins in cancer cell lines using a mass spectrometry-based proteomic approach.

Materials and methods: Genetic mutation data from publicly available databases was used to create reference libraries of protein fragments containing mutation for melanoma cell lines SK-MEL-28 and 1205Lu. Mass spectrometry-based proteomic data for these cell lines and non-cancerous cell lines HaCaT and primary melanocyte was searched against each database for the identification and quantitation of mutated peptide sequences.

Results: The final reference libraries for SK-MEL-28 and 1205Lu had 208 and two mutations respectively. Searching mass spectrometry data against the SK-MEL-28 library, 66 mutated proteins were detected in SK-MEL-28 (31.7% detection rate), 16 of which were also found in non-cancerous cell lines. Searching the data against 1205Lu reference library, one mutation was detected in SK-MEL-28 and HaCaT cell lines, and no mutations were detected in the primary melanocyte or 1205Lu.

Conclusion: Proteomics has to potential to detect mutations in melanoma cell lines. However, further studies are needed to validate the findings and improve mutation detection rates by developing more comprehensive mutated protein reference libraries and employing enrichment approaches for low abundance proteins.

Ansgar Fehnker, **Luke Glover,** School of Computing, Faculty of Science and Engineering, Macquarie University

Keeping Humans in the Loop: LLM Supported Oral Examinations

Background and aims: In the age of ChatGPT and other generative AI tools, it can be difficult to ensure academic ownership of student's work. This research investigates an innovative use of large language models to reduce the time burden of oral assessments on University staff in undergraduate software engineering courses, making them a more practical choice of assessment.

Method/process: A small prototype tool, called VivaMQ, which can automatically generate a viva based on a student's written submission, was developed as a proof of concept.

Results/findings: Academics from the Faculty of Science and Engineering and the Faculty of Arts at Macquarie University qualitatively judged the generated viva questions, and found they were generally of high quality and they would be suitable for us in assignment tasks.

Conclusion/implications/directions for future research: The purpose of the prototype tool was to ensure academic integrity, not as a complete assessment method. The current tool is limited by the large language models it has access to, and there is a risk of hallucination or unfairness, particularly when processing submissions from English as a second language students. Further research is needed to address these concerns before such a tool is implemented in a real-world assessment task. However, this tool is a promising first attempt at solving the problem of ChatGPT in universities in an innovative way.

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Developing Safe Modification Methods for Nutrient Adsorption

The world's fast-growing population has brought new and unforeseen environmental challenges. In response to growing demand for food, intensive agriculture has led to the pollution of natural waterways with excess nutrients like phosphorous and nitrogen. These nutrients are affecting water quality and pose a health threat to human and aquatic life alike. This project aimed at developing a method for nutrient removal that is relatively safe, cost effective, accessible and environmentally friendly.

An adsorbent was made using chitosan, an abundantly available biopolymer derived from crab shells. To improve its physical properties and adsorption capabilities, two types of functional modifications were investigated; crosslinkers to give the material favourable physical properties and functionalising agents which aimed at providing the surface with a positive charge to attract nitrate and phosphate ions. Each material was investigated for its adsorptive capabilities under different conditions e.g. pH and dosage response alongside surface charge testing and spectroscopy to determine their chemical structure. A chitosan material modified with MTAC ([2-(Methacryloyloxy) ethyl] Trimethylammonium), a quaternary amine, recorded a maximum of 80% (1.5 g/L) in in acidic conditions at 3 ppm phosphorous.

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Representing the Past: The Minor Details Matter

Written in 2017, Adania Shibli's *Tafsil Thanawiun (Minor Detail)* is centred around the rape and murder of a Bedouin girl in Palestine, 1949. Split into two sections, the novel details these atrocities, and a quarter century later tells of a woman who is determined to uncover the details of the girl's death. *Tafsil Thanawiun* is inspired by the Nirim Affair, where Israeli soldiers tasked with 'cleansing' the Negev desert wiped out an entire Bedouin community save for the one girl. This event was covered up by official histories until it was discovered in the former Israeli Prime Minister's journal almost fifty years later. From minimal information, Shibli attempts to resist the suppression of the Bedouin girl's tragic death by telling a fictional version of her story. In doing so, Shibli adds to the broadening pool of Palestinian literature that is reclaiming an identity which was irreparably marred by the 1948 Nakba. This drive to resist erasure has anti-colonial imperatives in that the discussion highlights the need to fight the hegemony of the grand narrative. It is here that this research contributes, exploring how we go about using fiction in such a space. A framework suggested by Dominick LaCapra, 'empathic unsettlement', proposed in *Writing History Writing Trauma,* is a possible avenue for exploring the capacity of fiction in unearthing stories that have been suppressed. Empathic unsettlement suggests that we recognise the fundamental otherness of one who has experienced trauma, at the same time that we experience a sense of empathy towards them. LaCapra highlights that this process aims to disrupt the way we approach traumatic events. Applying this framework to a study of Shibli's novel, offers an opportunity to explore the possibilities for fiction in actively working against the colonial narratives that have erased the experiences of the oppressed.

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Using Modified Tea Towel to Remove Phosphate from Water

Accelerated eutrophication is a major concern for the health of environmental waterways. It is commonly caused by nutrients, such as phosphate, entering waterways through agricultural runoff. This study produced and characterised a modified cellulose (cotton) material that was capable of removing environmentally significant amounts of phosphate from water.

The material was synthesised using 2-chloro-N,N-diethylethylamine hydrochloride (DEAE) to modify a cotton tea towel. Determination of the material's point of zero charge (PZC) found it to occur at a pH of 9.5. Unmodified cotton has a PZC of 6.1. This difference is likely due to the attachment of DEAE, and the resulting creation of positively-charged quaternary ammonium groups, which then attract negatively-charged phosphate.

The resulting material was able to adsorb up to 95% of phosphate in solution (8.8 ppm) after 3 hours of exposure, at a pH of 7.5 and a 2 g/L dose. A 0.1 M NaCl solution proved effective at regenerating the material, which allowed it to be used repeatedly with no diminishment in performance over 5 regeneration cycles. Non-linear Langmuir isotherm modelling demonstrated that phosphorous has a high affinity for the material, with a Langmuir constant of 2.06 L/mg. The presence of competing ions (NO_3^-, SO_4^{2-}, HCO_3^-, Cl^-) at environmentally significant concentrations reduced adsorption capability from 95% to 24%; however, this can be elevated to 76% using a greater dose rate of 16 g/L. These results indicate a very promising material for applications in environmental waterway remediation.

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Crossing Boundaries: Transferable Cell-Type Specific Biomarkers for Parkinson's Disease Diagnosis

Background and Aims: A persistent challenge in cell-specific biomarker development by machine learning is ensuring transferability between distinct datasets. As biology embraces AI-driven approaches, the inability of traditional differential expression (DE) analysis to maintain predictive power across datasets becomes increasingly urgent. This study aims to introduce a novel feature selection method for single-cell transcriptomics (scRNA-seq) to enhance biomarker transferability. It will be demonstrated for Parkinson's Disease (PD) diagnosis.

Method/Process: Three public scRNA-seq PD datasets, each containing billions of gene expression values, were cleaned, log-normalised and pseudobulked to address sparsity. Pairwise differences in gene expression were calculated as log-ratio features and predictive biomarkers selected by consistent performance towards diagnosis for each dataset pair. AUC scores were calculated for train-testing on every pair of datasets. A novel transferability score was developed, incorporating the coefficient of variation (CV) and the ratio of average AUC scores from within- and across-dataset testing. It was used to evaluate biomarker stability and transferability compared to traditional DE analysis.

Results/Findings: Promising feature sets were identified in both astrocytes and oligodendrocytes. In astrocytes, the CV and ratio scores were 9.77 and 1.09, respectively, compared to 28 and 1.53 for DE analysis. Similarly, in oligodendrocytes, scores were 12.61 and 1.12, contrasting with 30.83 and 1.20 for DE analysis. Together, these demonstrate that my method selected more stable and transferable features in both astrocytes and oligodendrocytes across distinct datasets.

Conclusions/Implications: This study is transformative, as it has the potential to establish a new standard for cell-specific biomarker selection that researchers globally can adopt. It marks a significant advancement in the adaptive change of medical research.

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Using Classification Models for Additional Security in NFC-based Access Control Systems

Background and Aim: Near Field Communication (NFC) is widely used in access control systems such as payment processing and regulating access to facilities. Due to its decentralised nature, NFC is limited by resource constraints which makes it vulnerable to exploits like key cloning. This study investigated the effectiveness of machine learning algorithms in visually distinguishing access cards as an added security measure against unauthorised cloned cards.

Method: The methodology includes collecting datasets, building classification models using CNN, KNN and SVM, performance evaluations and integration of the best-performing model into an NFC prototype. Two datasets—one noisy, one noiseless—each with 2,700 images across 9 classes, were curated for comparative purposes. Accuracy, precision, F1-score and recall metrics were used for performance evaluations.

Results: CNN was the best performing model with a prediction accuracy of 96%. Experimental results showed that noisy datasets produced a more robust model than noiseless datasets. Heatmap visualisations indicate that distinct colours and bold text regions contributed significantly to the model's decision making. Despite the high accuracy on test data, the prototype performed less accurately when classifying scanned cards for granting access.

Conclusion: The study provided a basic evaluation of classification algorithms, concluding that Deep Learning offered greater suitability to the use case. The implications of the prototype extended into the applied research domain, offering a configurable and deployable solution to improve the resilience of NFC-based access systems against unauthorised cloned cards. Data augmentation and annotations could be considered as a future work for improving performance.

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How Timing of Knowledge of a Hidden Facility Dog Impacts Juror Perceptions and Decision-Making in Sexual Assault Trials

Cases of sexual violence continue to have low conviction rates, despite increases in victimisation and reporting. To address this contemporary challenge, legal systems allow vulnerable witnesses special measures when providing evidence. One of these measures is the presence of a facility dog (i.e., canine companion) during testimony. In South Australia, where facility dogs can be used, the current recommendation is that they remain hidden. However, the limited previous research regarding the use of facility dogs during testimony has solely focused on visible dogs. As such, it is unclear whether unseen facility dogs can still impact juror decision-making and perceptions of a testifying witness, and whether the time that jurors are informed about the dog has any effect. In this study, participants were shown an animated video depicting testimony given in a sexual assault case and were then asked to complete two sets of decision-making questions (immediate and after completing a distractor task). Participants were also asked questions to explore their acceptance of rape myths, and their familiarity with, and beliefs regarding, different types of support dogs. We manipulated the emotional state of the witness, such that they appeared either calm or distressed when testifying. The time participants were told about the unseen dog was also manipulated, with participants being informed either before the video, immediately after the video, or just before the second set of decision-making questions. We will report the findings of this study, which can help inform future decisions about the use of facility dogs during victim-survivor testimony.

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Recombinant expression of sodium channel fragments to probe domain interactions in epilepsy

Background and aims: Voltage-gated sodium (NaV) channels are crucial for initiating and propagating action potentials in neurons, a fundamental process in brain function. In response to depolarising changes in membrane voltage, these channels rapidly open and close (process called gating), allowing Na ion through, which amplifies depolarisation as an action potential. NaV proteins are comprised of four homologous domains (I-IV), with the III-IV linker controlling fast gating. Mutations in this linker can disrupt gating, leading to disorders like epilepsy. Surprisingly, mutations in the Carboxy Terminal Domain (CTD) can have similar effects, due to interactions between the CTD and III-IV linker. This research aims to investigate these interactions by recombinantly expressing the NaV1.2 III-IV linker in E. coli as fusion proteins to GFP and GST in plasmids sfGFP-pSB1C3 and pGEX6P1. Purified III-IV linker would be used to measure interaction with already purified CTD.

Method/process: The plasmids were constructed using Gibson assembly to combine various components: purification tags, a fluorescence marker (sfGFP for both constructs), selection markers, a promoter region, and the domain III-IV linker as the protein of interest. Following vector construction, they were transformed into E. coli cells and constructs confirmed by miniprep and restriction digests. Expression of III-IV linker fusions was induced with specific agents and evaluated by SDS-PAGE.

Results/findings: Planned plasmids, 6His-TEV-sfGFP- III-IV linker in pSB1C3 (iGEM) and GST-TEV-sfGFP- III-IV linker in pGEX6P1 (pGEX) were constructed and confirmed by restriction digest. Unexpected results emerged in protein expression, with the induced protein from the iGEM plasmid being 50 kDa protein instead of the expected 35 kDa, while pGEX produced a 20-25 kDa fragment instead of 59.5-60 kDa. The pGEX plasmid was found to have a mutation causing an early stop codon. As both constructs include sfGFP, post-induction fluorescence was also assessed and found to be lacking in both cases and in the original 6His-TEV-sfGFP in pSB1C3, indicate there is a problem with the original sfGFP-pSB1C3 plasmid.

Conclusion/implications/directions for future research: This study aimed to construct III-IV linker cDNA fusions to 6His-GFP and GST-GFP in iGEM and pGEX plasmids, then express and purify the protein fusions. Our results, however, showed unexpected induced. protein sizes and a lack of fluorescence. Although the smaller size from the pGEX plasmid, was explained by a mutation within a primer region, the lack of fluorescence from the original sfGFP plasmid, suggesting issues with this plasmid.

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Biomarkers of Islet Cell Loss After Transplantation

Type 1 diabetes (T1D) is an autoimmune disorder where insulin-producing cells are destroyed, leading to high glucose levels and dependence on daily insulin injections. Islet transplantation is a promising cell-based therapy that offers the possibility of achieving insulin independence in T1D. However, transplantation outcomes are hampered by significant islet cell death within the first 24 hours post-transplant, leading to impaired graft function over time and necessitating repeat procedures. Identifying islet cell loss in early stages of post-transplantation period is essential for estimating the remaining islet mass, which is critical for predicting graft function and long-term success.

We aimed at identifying circulating biomarkers (microRNAs and proteins) that reflect islet cell death following transplantation. Plasma samples from 15 T1D patients were collected pre-transplant, 1 hour, and 24 hours post-transplant (n=45). We profiled 754 microRNAs, identifying several of them to be significantly elevated at 1-hour post-transplant (such as miR-375-3p, miR-216b-5p; $p<0.05$). Protein analysis revealed 125 unique proteins, with PIP4K2A (involved in phosphoinositide signalling) significantly upregulated at 1-hour post-transplant. Additionally, machine-learning and AI-based analyses were employed to identify baseline biomarkers that can predict graft function (measured as circulating c-peptide levels) at 1-month post-transplant. Currently, we are working on validation of these biomarkers in a separate cohort of 22 islet recipients.

Our work provides novel insights into early biomarkers of islet cell death following transplantation, thereby providing newer methodologies for improving graft monitoring and patient outcomes.

Keywords: Type 1 diabetes (T1D), Islet transplantation, Islet cell death, Biomarkers, MicroRNAs, Protein analysis

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Understanding the Air We Breathe: Chemical Analysis of Rainwater as a Proxy for Air Pollution

On average, an adult takes 22,000 breaths every day. But many of us never consider what might be in the air. Following the death of nine-year-old Ella KissiDebra, due to exposure to polluted air, the United Kingdom passed the Clean Air (Human Rights) Bill (2022).

Australia ranks highly amongst countries with the cleanest air. To maintain this claim, it is necessary to understand and monitor factors contributing to air pollution. The relationship between air quality and rainwater chemistry is well-documented; such research has not made its way to Australia.

Online CAD software was used to design a 3D printed attachment that could collect sufficient rainfall in standard laboratory centrifuge tubes. Samples were analysed using Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) and Ion Chromatography (IC) - particle size, pH and conductivity were also measured. Zinc, manganese, iron, barium, and strontium were found at low concentrations. IC was used to quantify anions such as nitrate, sulfate, or chloride. Concentrations of sulfate and nitrate were found to be below World Health Organisation (W.H.O.) limits for environmental waters, whereas the data for chloride were inconsistent. Particle size analysis proved to be of limited utility. The average pH was 5.85, and conductivity values (25-70 μs/cm) suggested low to moderate concentrations of dissolved solids. While these results are within the WHO's guidelines, the presence of zinc, barium and strontium in rainwater bears further investigation. Future research in this area should include analysis of seasonal variance and the use of artificial intelligence to enable real time analysis and interpretation of results.

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Information Cascades: The Effects of incorporating an informed or uninformed agent in Endogenous Time

Information cascades occur when it is optimal for a rational agent to act independently of her private signal and conform to the established pattern of actions by her predecessors (Anderson and Holt, 1997). This phenomenon is ubiquitous in settings where agents learn by imitating others, such as financial markets and nature. Yet, despite the vast research in this area, little is known about the propensity of cascades in an endogenous-time setting, especially when heterogeneously informed players are introduced. There is moreover scarce empirical evidence regarding how these players with differing signal qualities order themselves and their tendencies to wait strategically. This thesis investigates these unknowns using both a theoretical and experimental framework, reaching a coherent conclusion. Although cascades increased in duration when an informed player is introduced, the frequency and correctness of cascades were insensitive to the addition of a differently informed player. Furthermore, the environment in which cascades form are characterised by a tendency of players to act quickly (since waiting is costly) yet to also wait according to their level of private information.

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Cost-Effective Robotic Solutions for Enhanced Productivity in Vertical Farming

This study presents the "Free Roaming Magnetic Ceiling Robot," a cutting-edge, cost-effective robotic technology designed to enhance productivity in vertical agricultural applications. The robotic system consists of two main components: the top robot, a circular device capable of freely moving along the ceiling, and the bottom robot, a telescopic arm with vertical movement capabilities. The telescopic arm, equipped with a flexible gripper driven by a servo motor, facilitates the efficient execution of various tasks. The key innovation lies in the use of N36 magnets, each possessing a strong pull force of 24 kg, which enables the connection between the top and bottom robots. This magnetic coupling maintains stability while reducing overall system cost by maintaining a 1.6 cm air gap between the robots.

As part of the hardware integration, eight N36 magnets are carefully positioned to maintain the link between the top and bottom robots. Two specialized printed circuit boards (PCBs), the Top PCB and Bottom PCB, control the functions of each robot. Connectivity is achieved through Bluetooth and Wi-Fi, allowing seamless communication and efficient operation.

The study also explores an integrated camera-based fruit and vegetable identification system to enhance the robot's suitability for vertical farming. The detection process considers factors such as growth duration and colour recognition to determine the optimal harvesting time. This feature enables the robot to autonomously identify and harvest fruits and vegetables, thereby improving the overall efficiency of vertical farming operations.

Amanda R. Joyce, School of Life Science, Faculty of Science, The University of Technology Sydney

Identification of Gambierdiscus species from a single cell using a novel protocol

Gambierdiscus spp. is a genus of benthic autotrophic dinoflagellates that grow on a variety of substrates including corals, macroalgae and sediment. They are typically distributed throughout tropical and subtropical regions, however recently they have been identified in temperate regions of Australia and Japan (Heimann et al., 2011; Nishimura et al., 2014). The increased prevalence of these microalgae raises concerns regarding ciguatera fish poisoning, a severe health risk, as some species of this genus are potent cytotoxin producers (Lehane & Lewis, 2000). Samples collected from Beaver Reef, Great Barrier Reef, Queensland, Australia in October 2023 have microscopically identified *Gambierdiscus spp.*

In this study, a single cell is used to confirm the identification. Methods such as single cell isolation, single cell DNA extraction, PCR, gel electrophoresis, and sequencing are employed to achieve this objective. Notably, a new protocol for DNA extraction and PCR was developed to improve amplification from a single cell. This method has also been successfully tested on *Alexandrium pacificum*, another toxin-producing dinoflagellate. These advancements highlight the potential for more efficient single-cell analysis in future studies.

Agastya Kapur, Ansgar Fehnker, School of Computing, Faculty of Science and Engineering, Macquarie University; George Hobbs, Space & Astronomy, CSIRO

Standardising the Parkes Radio Telescope Data Processing Pipelines

Murriyang, the Parkes Radio Telescope operates twenty-four hours a day for most of the year acquiring astronomical data for cutting-edge research. It can produce up to terabytes of data a day that is archived to allow researchers to download and process to conduct research. To process this data, researchers would need to download large volumes of data which requires sufficient network bandwidth, disk space and hardware and software resources to process this data. Some of these processing requirements may be unavailable to astronomers. As radio astronomy enters the SKA era where data volumes would become much larger, it is essential for observatories all around the world to shift towards automated systems to provide researchers with science-ready data products. This would ensure that data is not only accessible to researchers with abundant computing resources to promote inclusivity.

Using the design science research methodology including conducting interviews, I identified eight processing pipelines that would automatically provide the data products required for around 95% of the current science uses of the telescope. I have developed five of these pipelines in detail and provided end-to-end tests of three. For those three, the developed pipelines outperform the typical pipelines currently being used by the astronomers. I have also provided solutions for containerising software for these pipelines and identified which CSIRO computing resources would be suitable to implement these pipelines on. I provide recommendations to the observatory staff to improve data archiving, calibration methods and data formats to further improve the telescope's operations.

Huzaifa Khan, School of Physics, Faculty of Science, The University of Sydney

Investigating Erbium Impurities in NaCl Crystals at Cryogenic Temperatures

The world is amid an AI revolution, but other disruptive technologies are on the horizon, such as quantum computing. While there are many ways being explored to build quantum technology, one appealing pathway is to use atoms, such as erbium in the solid state, focusing on impurities. One issue in using erbium for qubit work is that even if one starts with a material without erbium, the impurity levels of erbium are high enough to limit performance.

This project targets lab-grown NaCl crystals, which have the potential for low erbium impurity concentrations. Self-growing helps to understand the process of materials. NaCl was also targeted as it is easy and cheap to grow, and literature investigating erbium impurities in NaCl was not found.

The NaCl crystals were grown using >99% NaCl and distilled water in a controlled environment. It was found that to obtain clear crystals that are free from physical deformities it was necessary to control a variety of factors within their 'ideal' zones.

The paper will discuss high-resolution laser spectroscopy of the crystals. It will examine the measured erbium impurity background and discuss the implications for ultra-clean host crystals for erbium quantum technology.

Edlyn Kim, School of Psychological Sciences, Faculty of Medicine, Health and Human Sciences

Assessing Cognitive Load during Multitasking Using Non-Linear Analyses Measures and Pose Estimation

Individuals are increasingly assuming operator roles, which require multitasking performance that may decrease from suboptimal levels of cognitive load. Accordingly, real-time monitoring of the operator's cognitive load may be crucial within occupational contexts where performance decrements are detrimental. Thus far, limited research has examined cognitive load with a non-invasive temporal-based ocular metric, namely gaze and movement dynamics, recorded by an Eyelink tracker and a webcam and quantified by a %REC score from a Recurrence Quantification Analysis.

The study's primary aim was to examine whether there were differences in multitasking performance decrements and %REC scores between varying levels of cognitive load. In total, 45 participants engaged in 2 sessions of a pilot simulation game whilst a webcam and an Eyelink tracker recorded ocular data. Pose estimation, an AI technique, was used to extract head, eye, and pupil positions from the webcam data.

Ultimately, the current study's discordant results suggested that performance deterioration increased for higher cognitive loads, typically when sub-tasks relied on visual perception. Furthermore, the study failed to provide moderate evidence for differences in %REC scores, which encapsulate gaze dynamics, between varying cognitive loads. However, there was support for differences in %REC scores, which encapsulate movement dynamics of the head, eyes, and pupils, between very high and moderate cognitive loads. Consequently, the study provided foundational support for the rudimentary utility of the %REC scores in differentiating cognitive loads.

Future research could enhance these findings by employing AI models to analyse ocular data, potentially providing deeper insights into cognitive load variations.

Yoonji Kim, School of Medicine, University of New South Wales

"So now I feel I have somewhere to go to" Evaluating the Diagnostic Yield and Clinical Utility of an Undiagnosed Disease Program and Clinician Perspectives on its Value

Background: Rare diseases (RDs) affect over 450 million people worldwide. 40-70% of patients with suspected RDs remain undiagnosed due to limitations in knowledge, testing and analysis. Undiagnosed Disease Programs (UDPs), such as GeneAdd at Sydney Children's Hospitals Network (SCHN), aim to address this gap, but it is not known how to optimally integrate them into clinical care.

Aim: To investigate the integration of GeneAdd into SCHN clinical genetics service by

A) Assessing GeneAdd's diagnostic yield through whole genome sequencing (WGS) analysis.

B) Evaluating the clinical utility and overall value of GeneAdd's implementation.

Methodology: We used a mixed-methods approach.

1. Analysis of trio short-read WGS from four children through GeneAdd, using a phenotype-centric approach.

2. Evaluation of the perceived clinical utility of 34 GeneAdd reports through application of the quantitative tool Clinician-reported Genetic testing Utility InDEx (C-GUIDE).

3. Exploration of genetic professionals' views on GeneAdd's acceptability and value, guided by the Theoretical Framework of Acceptability and a validated Clinician Experience Measure.

Results & Discussion: This project offers initial clinician perspectives on the value of a UDP and considerations for best integration into clinical care. Perspectives of other stakeholders are being explored in the larger research program. A causative diagnosis was identified in one of four families, with three other candidate variants being identified for further research, reflecting the overall diagnostic yield of GeneAdd and similar UDPs. GeneAdd was perceived to have high clinical utility, comparable to clinical genetic testing, with strong acceptability and support for future adaptation and scaling.

Akito Koike, **Mani Shayestehfar**, School of Physics, Faculty of Science, The University of Sydney

Lie Symmetries of Nonlinear Partial Differential Equations of Optical Solitons

Background and aims: The Nonlinear Schrodinger Equation (NLSE) can be used to model the propagation of optical solitons in nonlinear fibres. Optical Solitons are stable, localised wave packets that remain undistorted over long distances due to balancing effects of nonlinearity and negative even dispersion. The NLSE only uses lower order dispersion effects, however it can be modified to consider higher order dispersion effects. Such variations of the NLSE have led to new frontiers in ultra-fast laser technologies and optical communication systems and promote innovations such as in high-speed data transmission. The solutions to some variations of the NLSE have not been investigated before, as solving these higher order differential equations becomes extremely complicated. The aim is to study and obtain solutions for some variations of the NLSE.

Method/process: We use mathematical tools from Lie algebra to obtain Lie symmetries of the differential equation. This allows one to find all the solutions of a given differential equation from just one particular solution.

Results/findings: We explicitly utilise it for a pure (only one dispersion term), quartic (order) soliton, then generalise to any higher order, pure soliton. We find that in both cases, there are precisely two symmetries, both which have already been found in experiment.

Conclusion/implications/directions for future research: No other solutions exist for those variations of the NLSE. For the future, the use of Lie symmetries should be applied for other variations of the NLSE, such as a mixture of different higher order dispersion times.

Jianne Lamadrid, Steven James, Judy Craft, Discipline of Nursing, School of Health, University of the Sunshine Coast

Undergraduate nursing students' knowledge of lifestyle modifications and long-term complications of type 1 and 2 diabetes

Type 1 and 2 diabetes is a significant health condition. Incidence is increasing worldwide, and the disease is responsible for significant morbidity and mortality. Long-term complications include increased risk of heart disease, stroke, cancer, and amputation; these can be delayed by optimal glycaemic control, including through appropriate lifestyle behaviours. As nurses are a highly trusted profession, and spend considerable time with patients, they have a key role in educating regarding nutrition, exercise, and central obesity. This personal education provided by nurses is unlikely to be effectively obtained through artificial intelligence; therefore, it is essential that nurses gain this understanding during their undergraduate education.

An integrative literature review was conducted following the steps of problem identification, literature search, data evaluation, data analysis and presentation. Four databases were searched, using defined MeSH headings and keywords. Covidence software was used to assist screening relevant articles and date extraction. Overall, six articles were included in this review.

Results showed that the extent of undergraduate nursing students' knowledge regarding diabetes varies, improves with additional and targeted education, and calls for changes in nursing curricula. Although artificial intelligence has the potential to inform how diabetes-related content is learned, review findings confirm that nursing students need a thorough understanding of factors that impact glycaemic control, to inform their future roles in patient education. Despite advances in artificial intelligence, nurses will continue to have a key role in providing patient education to reduce serious complications for patients with type 1 and 2 diabetes.

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Enhancing the Detection of Vicarious Touch: A Novel Visual-tactile Interference Task

Touch is highly meaningful in our lives, and even when we see someone else being touched, it can evoke similar feelings in ourselves. This is known as *vicarious touch* and is typically identified by asking participants if they feel a touch when seeing a video of touch. Our study seeks to develop an objective method for identifying people who experience vicarious touch, both in the general population and the more extreme case of mirror-touch synaesthesia, where vicarious touch is experienced consistently in daily life. If a touch is felt when seeing touch, this additional experience could influence perception of an actual touch. Indeed a few previous studies have shown that people with mirror-touch synaesthesia are slower and less accurate in their response to a felt touch if watching a differently located touch, than if the two locations match (a congruency effect). However, the reliability of these findings is variable; some controls show a congruency effect too. This variability suggests that current tasks lack sensitivity to detect the full spectrum of vicarious tactile experiences that may exist.

Here, we present a highly controlled visual-tactile congruency task. Participants respond to a touch to their little finger or thumb while watching videos of touch to the same or opposite finger location. We link these behavioural responses to participants' subjective experience of vicarious touch, assessed using a previously developed questionnaire. Our task may provide an objective measure for vicarious touch and give additional insight into how visually perceived touch and actual touch interact.

Flynn Lauridsen, School of Computing, Faculty of Science and Engineering, Macquarie University

Translucent AI: A small field with some growing opportunities

Background and aims: To create a rapid and maintainable pipeline for automatic classification of YouTube videos.

Method/process: The study primarily used the Snorkel framework, available on Python's Pip package manager. We used a typical machine-learning routine of creating a ground-truth dataset to train and test on, with the addition of an investigation phase to determine heuristics for snorkel to use.

Results/findings: Our findings were that Snorkel presented as a strong solution to the problem, achieving significant F1 scores of around 0.77 with room for improvement as the dataset size and efficacy of heuristics improve.

Conclusion/implications/directions for future research: While the following direction originally was to utilise this pipeline and demonstrate the robustness of the Snorkel framework overtime, this has changed. With industry's move towards AI governance, Snorkel and similar frameworks now present a niche for "translucent" and "human-readable" AI which may better comply with recent government recommendations and can avoid pitfalls of past AI systems, such as tendencies for discrimination. I hope to raise discussion about further possibilities for such systems and spark investigation into whether such systems conclusively stand to at least partially solve these industry problems.

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On Non-Integrability and Singularities of Dispersion-Generalised NLSE

One of the most important and widespread equations in physics is the Nonlinear Schrodinger Equation (NLSE). In particular, it describes the behaviour of a type of stable optical wavepacket called a soliton. These solitons arise from balancing two effects: nonlinearity, where the wave's leading and trailing edges become shifted in colour, and second-order dispersion, where the wave's speed depends on its colour. The NLSE has the special property of integrability, which gives it a full set of conserved quantities and allows it to be analysed with a useful mathematical toolkit. While various generalisations of the NLSE have been proposed, researchers at the University of Sydney have recently experimentally created solitons with higher orders of dispersion.

This motivated us to examine the equations describing solitons with high-order dispersion in full generality, and in particular test if any such equations also have the property of integrability. By applying the Painleve test, which involves passing the equations through a series of necessary conditions for integrability, we proved that none of the equations are integrable. We then investigated the nature of the solutions of these equations and discovered that the existence of branch point singularities was causing them to fail the Painleve test. As no over-arching statements about these dispersion-generalised equations have yet been made, our discovery of non-integrability is the first such general result.

Keywords: soliton, integrability, Painleve

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Longitudinal Assessment of Medical Students' Perceptions of Social Isolation and Wellbeing: A 5-Year Analysis of FRAME Surveys (2017-2022)

Background: The geographical remoteness of rural clinical school (RCS) placements presents unique challenges to medical students, possibly undermining their wellbeing and causing social isolation. Understanding these challenges is essential for medical institutions to implement effective support mechanisms.

Objective: This study investigated medical students' perceptions of their well-being and social isolation during a five-year period (2017 to 2022) during their RCS placements.

Methods: Data from approximately 600 medical students collected annually across 17 Australian universities were extracted through self-administered FRAME (Federation of Rural Australian Medical Educators) surveys. The main outcomes were social isolation and well-being, which were derived from students' responses to the statements, '*I felt socially isolated during my RCS placement'*, and *'Overall, my RCS placement impacted positively on my well-being',* respectively. Data was analysed using descriptive statistics to assess trends and changes, and binomial logistic regressions to identify factors associated with students' perceptions of social isolation and well-being.

Results: An average of 80.9% of Australian medical students reported their rural placement positively impacted their wellbeing. Whereas, over half of students felt socially isolated and this percentage increased by 23% from 2017 to 2022. Factors contributing to social isolation and poorer wellbeing included academic isolation, non-rural background, and lack of academic, financial, or general support by the RCS. Positive influences included active role modelling of self-care and informal information regarding rural career options. Notably, COVID-19 did not have a significant impact on social isolation and well-being.

Conclusions: These findings underscore the importance of tailored support mechanisms to enhance wellbeing and mitigate social isolation among medical students, potentially increasing retention of doctors in rural and remote areas.

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Investigating Self-Compassion's Effectiveness in Protecting Against Masculinity Threats

Background and aims: Masculinity threats, which involve challenges to a man's gender identity, reliably elicit negative affect and aggressive cognition. No published studies have examined how these threat responses could be moderated. This study fills this gap in the research by examining whether a brief self-compassion intervention could moderate the negative emotional and cognitive responses reliably observed following a masculinity threat.

Method/process: Fifty-three men were randomly assigned to complete either a self-compassion or control writing task before receiving a masculinity threat. The masculinity threat involved false feedback that their performance on a gender knowledge quiz was more typical of women than men. Measures of anger, guilt, and shame were collected pre- and post-threat, and scores of public discomfort and aggressive cognition were compared after the threat. Participants who completed the self-compassion task were expected to show less increase in negative affect and have lower scores of public discomfort and aggressive cognition.

Results/findings: Contrary to these hypotheses, the self-compassion task did not significantly moderate increases in negative affect compared to the control group, and there were no group differences in scores of public discomfort or aggressive cognition. These findings suggest that self-compassion, as utilised in this study, does not moderate masculinity threat responses.

Conclusion/implications/directions for future research: However, several methodological and practical limitations may have affected the results. As such, further research that accounts for this study's limitations is needed to conclude whether self-compassion may moderate masculinity threat responses.

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Comparative Efficacy of Psychological and Pharmacological Interventions for Chronic Pelvic Pain in Males

Background and aims: Chronic pelvic pain disproportionately affects males, yet studies predominantly focus on females. This research compares the efficacy and side effects of psychological interventions, particularly Pavlovian conditioning, against pharmacological treatments in male populations, aiming to identify optimal management strategies with minimal adverse effects.

Method/process: A systematic review of randomized controlled trials was conducted, focusing on psychological and pharmacological interventions for male chronic pelvic pain. ChatGPT was instrumental in the initial data collection phase, extracting titles, publication years, and author details from databases. This automation significantly enhanced the efficiency of the review process, allowing researchers to concentrate on analyzing outcomes related to pain intensity, emotional response, and physiological markers.

Results/findings: Preliminary findings suggest that psychological interventions, notably those utilizing Pavlovian conditioning principles, may achieve pain management efficacy comparable to pharmacological approaches with potentially fewer side effects. This indicates a substantial basis for considering psychological treatments as primary or complementary therapies in male chronic pain management.

Conclusion/implications/directions for future research: Employing ChatGPT for routine data collection has considerably increased research efficiency by reducing manual labour and allowing for a more focused and detailed analysis of complex data. The study highlights the necessity for gender-specific research in pain management and advocates for the broader integration of AI tools to enhance the accuracy and speed of clinical research. Future studies should further explore the long-term outcomes of psychological interventions and continue to leverage AI to refine research methodologies in healthcare.

Tommy Y. Lu, School of Chemistry, Faculty of Science, The University of Sydney

A Machine Learning Paradigm for mRNA Display Selection

Background: mRNA display is a screening technique that can select peptides against a drug target through iterative binding and amplification cycles. This method is used in drug discovery where sequences that enrich for the target can be optimised for therapeutic use. Taking the most enriched peptides as the top hits is the current conventional approach. Yet this method is fallible, as non-specific hits can arise due to insufficient screening, random distribution and inherent biases in the selection methodology.

Aims: Establish benchmarks for deep sequencing data quality and mRNA display selections across rounds. Assess these benchmarks across multiple studies with machine learning and biostatistical methods to ascertain the quality of hits identified under the current standard of display selection.

Method: A pipeline was developed to extract, clean, and unify deep sequencing data. A sequence space model was designed by evaluating the complementarity of embedding and dimensionality reduction methods. Clustering, regression, and neural networks were then employed to quantify and characterise round selection.

Results: Sequence space benchmarks effectively delineated between datasets by metrics of quality. Physico-chemical properties could be assigned on a motif level. Divergent hit families were identified and isolated for further investigation.

Discussion: The inadequacy of selection in several studies demonstrates the necessity of improved rigour in mRNA display deep sequencing screens. The achievement of key benchmarks ensures higher quality and preserves the consistency of enrichment. Collective findings pave the way for new peptide designs in *de novo* drug candidate generation.

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PeptAIde: An ensemble approach for accelerating the discovery of antimicrobial peptides against priority pathogens

Background: Antimicrobial resistance (AMR) poses a significant global health threat, with estimates suggesting it could cause 10 million deaths annually by 2050. As traditional antibiotics become less effective, alternative treatments, such as antimicrobial peptides (AMPs), are increasingly crucial due to their broad-spectrum activity and minimal resistance development. However, identifying natural AMPs is typically slow, costly, and complex. Our study employs advanced computational methods, combining pattern recognition (PR) and deep learning (DL), to accelerate the discovery of AMPs from the phage pan-proteome.

Methods: We utilized a combined PR and DL approach to scan evaluate approximately 1.5 million proteins from the phage pan-proteome. We shortlisted 23 AMP candidates, prioritizing diversity in sequence and phage origin. These candidates were then tested against various multi-drug- resistant bacteria to assess their antimicrobial potency, mechanism of action, and in vitro cytotoxicity.

Results: All selected AMPs exhibited more than 25% inhibitory effects on at least one drug-resistant bacterial strain at a concentration of 60 μM. The average minimal inhibitory concentration (MIC) was 10 μM, notably lower than the 10 mM MIC typical of peptides in public databases. Membrane permeabilization assays and microscopy, coupled with live/dead staining, revealed that these AMPs induced membrane disruption and cell death in a dose-dependent manner. Significant inhibition ($p<0.05$) was observed across strains, with all experiments performed in at least three biological replicates.

Conclusion: Our ensemble AI approach successfully identified potent AMPs within phage proteomes, showcasing the effectiveness of computational tools in accelerating AMP discovery. This presents a promising strategy for developing cost-effective antimicrobials to combat AMR and showing that phage biological data may hold untapped potential for the next generation of antibiotics.

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Investigating the Ball Impact Response of Shear-Thickening Fluids Across Different Temperatures

Shear thickening fluids (STF) exhibit a unique property of an increase in viscosity with applied shear stress, a characteristic that has been extensively studied within a range of temperatures above 0℃. However, the behaviour of STFs across a broader spectrum of temperatures, especially subzero, remains less investigated.

This study aims to expand the existing knowledge by examining the impact of varying temperatures, ranging from room temperature (20℃ to 0℃) to subzero conditions (-5℃ to -15℃), on the viscoelastic properties of STFs. Unlike conventional rheometer-based analyses, this investigation employs a ball drop test to assess the impact of temperature on STFs using steel and marble balls dropped from a height of 4 meters. The coefficient of restitution (COR) of the balls was utilised as a key metric to quantify the viscosity of the STFs.

The results indicated a pronounced rebound of the STFs at subzero temperatures, with maximum heights observed at -5℃ for the steel ball and -10℃ for the marble ball, respectively. These findings were corroborated by the COR values, which also peaked at these temperatures. This suggested that the critical shear rate for the STFs was achieved under these conditions. In contrast, at temperatures above 0℃, the STFs showed a minimal rebound, indicating a lower viscosity state.

This research provides novel insights into how a broader spectrum of temperatures influence the behaviour of STFs, which could have implications for their application in various industries, especially those operating in extreme temperature environments.

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Mobile applications to improve self-management practices in kidney disease and its risk factors: Are there any artificial intelligence-based tools?

Chronic Kidney Disease (CKD) is a leading cause of death in Australia, primarily driven by risk factors like diabetes and hypertension. Mobile health technologies offer innovative means to support CKD self-management practices including strict medication adherence, dietary restrictions, and lifestyle adjustments. However, there is a paucity of data about such technologies for CKD.

This study explored mobile apps for CKD self-management and evaluated their quality using the Mobile App Rating Scale (MARS), focusing on engagement, functionality, aesthetics, and information.

A systematic search of the Apple App Store and Google Play identified six apps, two CKD-specific and four non-specific (relevant to diabetes, hypertension, and CKD). CKD-specific apps tended to lack comprehensive functionality, with some excelling in one aspect (e.g., dietary guidance) but failing in others (e.g., medication adherence). Non-specific apps offered more integrated features, but their CKD-specific functionality was limited. Based on MARS criteria, apps ranged from “Poor” to “Good” in engagement and functionality, with none rated “Excellent.”

In conclusion, CKD-specific apps showed inadequate engagement and functionality compared to non-specific apps. Future app development should focus on creating interactive, user-friendly features, including AI-powered Q&A tools, symptom tracking, real-time dietary modifications, and medication management, to enhance self-management of CKD.

Alex More, Faculty of Arts and Sciences, University of Notre Dame Australia

Mapping Decay: Thomas Ligotti's Fiction and the Decline of the American City

Thomas Ligotti's fiction emerged in the late twentieth century with the 1985 publication of Songs of a Dead Dreamer; the release of a Penguin Classics edition in 2015 canonised Ligotti as a raconteur of Weird fiction. In its interest in the horror of urban spaces, Ligotti's fiction stands apart from its generic lineage in both gothic and Weird, relocating the American Weird story from the Lovecraftian small town or Brown's isolated homestead and re-temporalising it from some kind of vague ancestral-fantasy past into an urgent contemporaneity. Ligotti thereby occupies a unique position as one of the few critical chroniclers of urban decay in fantasy literature.

Despite the pertinence of Ligotti as a prophet of decay, existing scholarship on his fiction frequently eschews a close discussion of the spatial dimensions of his horrors, with Brawley's essay the only extant scholarly treatment of this subject. My thesis addresses this oversight, reading Ligotti's rendering of urban decay in terms of Kristeva's theory of the abject, which is achieved through a combination of setting and a narrative structure which either decays and implodes, or inverts. I claim that this latter formal feature, which I call the "Ligottian flip," produces the most horrific abjection of urban space. Through a close discussion of Ligotti's urban renderings in relation to the work of critical urban theorists Edward W. Soja, Dora Apel and Mike Davis, my thesis therefore suggests that, in their staging of the urban as abject – in their rendering of urban decay vis-à-vis the tropes of Weird fiction – Ligotti's stories dialectically reflect cultural anxieties regarding the decline of the American city in postmodernity, while the erosion of their narrative logic embodies the process of urban decay.

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Investigating Immune Cell Migration across the Blood-Brain Barrier in Multiple Sclerosis Patients under Immunomodulatory Treatment

Background and aims: Multiple Sclerosis (MS) is an immune-mediated disease that affects the central nervous system and is characterised by demyelination. Early inflammatory changes in MS disrupt the integrity of the blood-brain barrier (BBB) allowing autoreactive leukocytes to migrate into the brain and damage myelin. Current treatments for MS aim to reduce disease activity by modulating such immune responses. Alemtuzumab, an anti-CD52 antibody, depletes immune cells that express CD52 and has been shown to induce long-term disease suppression in people with the relapsing-remitting type of MS. The effect of alemtuzumab on circulating lymphocytes has been well characterised, lesser known is the impact on innate subsets like dendritic cells and monocytes. The aim of this study was to investigate the effect of alemtuzumab treatment on the transmigration of B cells, dendritic cells and monocytes in an in-vitro model of the blood-brain barrier.

Method: Peripheral blood mononuclear cells from healthy subjects, untreated and alemtuzumab-treated MS patients were added to a transmigration assay based on human brain microvascular endothelial cells and their migration was assessed.

Results: Deep phenotyping of circulating cells revealed that alemtuzumab significantly reduced total dendritic cell, mature plasmacytoid dendritic and memory B cell numbers. Alemtuzumab did not impact the trans-endothelial migration of leukocytes.

Conclusions: Our findings show that while alemtuzumab exerts effects on specific circulating dendritic cell and B cell subsets, it has no effect on the transmigration of B cell or innate cell subsets. This depletion of specific leukocyte subsets in the periphery may contribute to reduced disease activity in people with MS.

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Play (-): On a Mimetic Politic

For most, growing up is a process. In doing so, many exclude play from their lives; it is as if adult freedom entails forgoing that which was natural since birth. Play, in being colloquially understood as opposed to work, promises an alleviation from the stresses of labour. It is a unique space in which the individual can experience life as they desire; this is the case especially for children. That in adulthood, it is impossible to escape seems to present a grave danger.

Through a critical theory methodology, I turn to Walter Benjamin's little-known essay 'On the Mimetic Faculty,' to rethink play. There is a long philosophical history of mimesis from Rousseau to Wittgenstein, but it is Benjamin's work which offers a reading of mimesis as a form of emancipated play. Further, as imitation is present in forms of art and language, the schooling of this mimetic faculty thus contains great political consequences which should be taken seriously. To that end I endeavour to explore the ways in which mimesis operates in its liberated state, the revelatory quality in its enactment, and the way in which mimesis can awaken the individual to sensory perception, reason, and history. This corrects an understanding of mimesis which casts it as a hallucinogen by seeking to reclaim its potential. Additionally, given the apparent contemporary ambivalence towards play, this project also intends to explore the nature of society enduring play's absence and the way in which social worlds become linear and constrained as a result.

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Development of Glycotherapeutics to Alleviate Chronic Inflammation

As of 2024, almost half a million Australians living with diabetes will experience complications from impaired wound healing. This increases the risk of severe infection, which can progress to tissue necrosis and, in extreme cases, necessitate limb amputation. Standard biomaterial interventions, such as wound dressings often fall short of preventing the occurrence and escalation of infection. As such, there is a pressing need to develop advanced wound dressings with enhanced therapeutic properties to promote effective healing.

A promising solution to this challenge may lie in glycotherapeutics, which utilize carbohydrate-based molecules such as heparan sulphate. Heparan sulphate is a highly charged linear carbohydrate in the extracellular matrix of many complex organisms, functioning as a co-receptor and stabiliser of over 400 proteins and signalling molecules. As such, HS can potentially target specific biological processes, such as inflammation and wound repair.

In this study, heparan sulphate variants with a high binding affinity to an anti-inflammatory protein were isolated using a novel affinity isolation chromatography methodology. Surface plasmon resonance in a competitive binding assay was used to compare the binding affinities of isolated variants and identify the optimal isolation process. Disaccharide composition was also analysed using strong anion exchange HPLC, revealing subtle differences in composition.

This study successfully identified a heparan sulphate variant with a high binding affinity to an anti-inflammatory protein, which could be incorporated as part of a wound dressing biomaterial to modulate healing. This innovative approach could improve chronic inflammation, reduce infection incidence in people living with diabetes, and improve overall patient outcomes.

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Formation of the embryonic skeleton in the seahorse *Hippocampus abdominalis*

Seahorse (*Hippocampus* spp.) embryos develop within a paternal organ called the brood pouch, which isolates them from the external environment, making them an excellent system to study the adaptive benefits of pregnancy. Facilitated by a close association within the pouch, many nutrients are transported to the embryos by the father. One of these nutrients is calcium, which is necessary for the calcification of the vertebrate skeleton and the bony plates characteristic of syngnathids. However, the extent of embryonic bone formation within the brood pouch and the calcium required by the embryos is not clear. Knowing both is necessary to understand seahorse biology and evolution.

I investigated the extent of embryonic skeletal calcification and bone formation in the seahorse *Hippocampus abdominalis,* examining embryos of different stages, and neonates. I used microcomputed tomography (μCT) and histology (using the stains Alizarin Red S and red-blue-green trichrome) to examine their skeletons. Calcification was evident in mid-stage embryos and became extensive as the snout developed in late-stage embryos, and was widespread in neonates. In the cranial skeletons of the late-stage embryos and neonates, cartilage structures were undergoing perichondral ossification, their peripheries were calcified. I found that many structures involved with vision, feeding and movement form and calcify before birth, indicating a high demand for calcium during embryonic development in *H. abdominalis*.

In the future, how the calcium required for embryonic skeletal calcification is supplied within the pouch needs to be further investigated.

Keywords: skeletogenesis, ontogeny, Syngnathidae, calcium, development

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A High-Pitched Blink: Investigating Visual Motion-Sound Synaesthesia

Synaesthesia is a rare condition in which a sensory stimulus triggers an unusual experience. We are investigating a type of synaesthesia known as *visual motion-sound synaesthesia*, in which people hear sounds when they view (silent) moving stimuli. There is very little research into visual motion-sound synaesthesia, and as a result there is a lot to uncover. For example, we do not know how prevalent it is, what types of motion cause these experiences, and what sounds are commonly heard. We have developed a screening tool to identify people with this condition and learn more about their experiences, which will form the first Australian study of visual motion-sound synaesthesia. Studying these unusual sensory experiences will benefit not only synaesthesia research but can also improve our understanding about how the brain integrates vision and sound information.

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Kolmogorov Arnold Networks: An interpretable and accurate Alternative to MLPs for Stochastic Data Forecasting

Background and aims: This research project explores the use of Kolmogorov Arnold Networks (KANs) for forecasting stochastic data, in this case we use stock market data, given the challenges posed by the highly random (stochastic) nature of market data. The study aims to assess KANs in terms of both prediction accuracy and model transparency, comparing their performance to that of established deep learning models like Long Short-Term Memory (LSTM) networks, which, while accurate, lack interpretability.

Method/process: The study uses historical stock data, applying KANs and LSTMs to forecast trends and approximate the underlying functional relationships. KANs offer a structured approach based on the Kolmogorov-Arnold theorem, which enables transparent representation of complex patterns, while LSTMs are widely recognized for their predictive power in sequential data but they lack interpretability. Models were evaluated based on error metrics, such as Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) to understand their performance balance.

Results/findings: Initial findings indicate that while LSTMs achieve higher predictive accuracy, KANs are not as accurate but by their design are highly interpretable, with structured insights into the model's decision-making. However, KANs' performance on highly random data requires further refinement for improved accuracy, highlighting the need to develop specialised architectures based on KANs instead of MLPs.

Conclusion/implications/directions for future research: KANs represent a promising pathway for creating models that balance accuracy and interpretability, essential in fields where understanding model decisions is as critical as the predictions themselves. Future research could focus on developing specialised architectures for KANs and integrating dimension reduction techniques with KANs.

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Dark Tetrad of Personality and Cyberbullying: The Role of Hostile Attribution Bias, Social Intelligence and Parental Emotional Warmth

Cyberbullying is an emerging issue within the university context and associated with adverse outcomes, including academic neglect and even suicidal ideation. Despite this, cyberbullying research has predominantly focused on school aged populations. Consequently, factors contributing to cyberbullying within higher education settings remain largely unknown.

However, two factors that have been linked to cyberbullying among university populations are the dark tetrad traits of psychopathy and sadism. Investigating variables moderating the relationship between these dark tetrad traits (i.e., psychopathy and sadism) and cyberbullying perpetration may reveal risk and protective factors for university cyberbullying. Some unexplored candidates for moderation include hostile attribution bias, social intelligence, and parental emotional warmth. Hence, the present study aimed to investigate whether hostile attribution bias, social intelligence, and parental emotional warmth moderate the relationships between these dark tetrad traits (i.e., psychopathy and sadism) and cyberbullying perpetration among university students. It was hypothesised that higher levels of hostile attribution bias, greater social intelligence, and lower parental emotional warmth would strengthen the positive association between the dark tetrad traits (i.e., psychopathy and sadism) and cyberbullying perpetration. As such, a self-report survey was administered to 316 undergraduate psychology students, assessing their levels of dark tetrad traits, cyberbullying behaviours, hostile attribution bias, social intelligence, and parental emotional warmth.

Unexpectedly, bootstrapped regression analyses did not find any significant moderating effects. By identifying non-significant moderating effects, this study may provide valuable guidance for future researchers to identify factors significantly intensifying or buffering the relationship between the dark tetrad and cyberbullying perpetration. Thereby potentially informing intervention programs aimed at mitigating cyberbullying in the university context.

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Are AI Models Too Bootylicious? The perceptual effects of exposure to curvaceous bodies

It is well-established that visual exposure to images of extreme bodies in media can cause body image distortion in the form of body dissatisfaction and misjudgement of one's own body size and shape. The rapid adoption of AI-generated models and AI-enhanced photo editing, producing ever-more unattainable figures, may exacerbate this problem. These effects may be underpinned by "visual adaptation", where prolonged exposure leads to an aftereffect of body size overestimation following exposure to thin bodies, and vice versa. However, there has been limited research on body curvature, which is increasingly vital given the health risks associated with "slim-thick" and "apple" body shapes.

We asked whether bodies with extreme curvature, measured by the waist-to-hip ratio (WHR), could induce a perceptual aftereffect, and if so, whether it is independent of those induced by high/low body weight, measured by body mass index (BMI). Participants (N=120) used a body manipulation tool to measure their perception of WHR and BMI before and after exposure to bodies with extreme WHR or BMI.

Curvature aftereffects were observed following adaptation to bodies with extreme WHR but were not induced by adaptation to bodies with extreme BMI. Conversely, weight aftereffects followed exposure to bodies with extreme BMI, but not bodies with extreme WHR. These findings are consistent with the encoding of body curvature and weight by independent neural mechanisms. Further, they have implications for restrictions or guidelines on the bodies used in advertising and social media, and for the design of improved treatments for individuals experiencing body image distortion.

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Can AI Lead a Team? Exploring Communication, Movement Dynamics, and Compliance in Human-Autonomy Teaming

Artificial intelligence (AI) is advancing at a rapid pace, and its potential for assisting teams to perform complex strategic tasks has been gaining attention in recent years. The current study aimed to: (1) explore whether an AI agent can successfully lead a group of human teammates and (2) identify potential decision-making or communication barriers to human-equivalent leadership.

To achieve this, a novel heuristic and large language model (LLM) composite agent was deployed as an 'operator' (i.e., team leader) in a multiagent herding game. Thirty-six teams of three participants acted as 'ground players'. The leadership suitability of the AI agent was assessed by comparing team performance, communication, player movement dynamics, and instruction compliance between human- and AI-led teams. Teams experienced a task difficulty manipulation and were assigned to a female- or male-voiced operator.

Multilevel mixed-effects modelling demonstrated that AI-led teams took up to 65% longer to complete the task than human-led teams, and demonstrated poorer target-search efficiency. AI-led teams also exhibited lower coordination, situational awareness, and compliance. Gender effects revealed different communication strategies between human operators and teams with the female-voiced AI operator exhibited the worst team performance. These results may be explained by the AI agent's rigid decision and communication strategies or its 'direct' linguistic style which is misaligned with gender biases against female voices.

Future studies should consider using LLMs for decision-making, since a rule-based model was unable to deliver trustworthy communication and facilitate coordinated team action in a simple videogame environment.

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Infant Directed Speech: A Human Role AI Can't Replicate

Background and aims: As AI systems become more prevalent in educational and social contexts, understanding human communication dynamics, especially in foundational language development, is imperative. This study investigated whether caregivers visually exaggerate their vowels (visual hyperarticulation) in Infant Directed Speech (IDS) compared to Adult Directed Speech (ADS) and its implications for infant language acquisition. Specifically, it explored whether mothers visually hyperarticulate the corner vowels /a/, /i/, and /u/ when speaking to infants.

Method/process: A longitudinal study involving 20 mothers interacting with their infants at 4, 7, 10, and 13 months was conducted using a double video setup. Video recordings of caregiver-infant and adult-adult interactions were analysed to compare the vertical and horizontal aperture of mothers' mouths during IDS and ADS using motion-tracking software (OpenFace).

Results/findings: Mothers significantly exaggerated their mouth movements during IDS compared to ADS, with greater horizontal aperture observed in IDS. This suggests that mothers use both auditory and visual cues, including visual hyperarticulation, to enhance vowel clarity for their infants.

Conclusion/implications/directions for future research: The findings indicate that caregivers visually emphasise vowel articulation, helping infants in distinguish speech contrasts and connect them to phonetic patterns, supporting early phonological development. Future research should examine the role of smiling on visual hyperarticulation and its developmental trajectory. These insights could inform early interventions for language delays, potentially integrating AI tools to complement human input. While AI can generate language, it lacks the emotional and contextual nuances of human communication, highlighting the irreplaceable role of humans in infants' language development.

Keywords: Infant Directed Speech (IDS), Visual hyperarticulation, Language acquisition, Vowel articulation, AI in language development, Early language development

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A Narrative Review of The Acute and Long-Term Effects of Repeated Non-Concussive Impacts on Mental Health of Athletes

Background and aims: This narrative review investigates the acute and long-term effects of repeated non-concussive head impacts (NCHI) on athletes' mental health. NCHI, common in contact sports, often lacks immediate symptoms and is thus overlooked. Accumulating evidence links these impacts to enduring cognitive and emotional challenges, addressing a significant gap by focusing on the psychological and neurophysiological consequences of NCHI, a less-studied area compared to concussive injuries.

Method/process: Preliminary electronic searches were conducted using SPORTDiscus, PubMed, and Google Scholar databases, assisted by AI tools, including ChatGPT, Consensus, and Perplexity, to facilitate a thorough and efficient literature search. This approach enabled a comprehensive synthesis of findings on structural brain changes and neuroinflammatory markers related to memory and emotional regulation in athletes.

Results/findings: The literature indicates that NCHI exposure correlates with higher incidences of depression, anxiety, and cognitive impairments. Findings also suggest that cumulative effects of NCHI may lead to microstructural brain changes, including white matter damage and neuroinflammation, which pose long-term risks for neurodegenerative diseases. These findings highlight the need for sport-specific monitoring and intervention protocols, as current guidelines largely address only concussive injuries.

Conclusion/implications/directions for future research: This review advances our understanding of sports-related head injuries, emphasizing the need for tailored mental health support and early interventions to safeguard athletes' long-term well-being. Future research should explore longitudinal monitoring of NCHI effects across different sports to improve preventive measures and establish more comprehensive injury assessment standards.

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Peaks of Twitter Activity: Investigating the Drivers of Viral Information Spread on Social Networks

Aim: In an era of rapid AI advancements, information spreads more widely, but wisdom remains scarce. This study investigates the drivers of viral information spread on social networks, focusing on the interplay between content fitness (e.g., novelty of content) and network structure (e.g., users' follower count). Understanding what drives viral content can inform efforts to build social networks that promote truthful information.

Method: Our dataset consists of all Twitter posts from 2019-2022 containing the word "climate", along with metadata such as user information. Viral extreme events were identified from a cleaned time series that tracks daily activity. These extreme events were further analysed to explore their dynamics and the factors driving their spread.

Results: Correlation analyses revealed that extreme events are more influenced by the fitness of the content than by network structure. Specifically, we observed a stronger relationship between content innovation rate and event size during extreme events. In contrast, a network's structural metrics -- such as maximum follower counts -- showed no significant correlation with the extreme events compared to business-as-usual periods.

Next Steps: We plan to develop a network model, where nodes and edges represent users and their relationships. We will then simulate information spread and adjust parameters related to fitness and structure. By comparing real-world data with simulated results, we aim to determine where the real network lies within a fitness vs. structure landscape. In the age of big data and AI, this contributes to developing automated metrics for detecting misinformation spread in real time.

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Optimal Stopping & Sequential Decision Making

The way in which we approach decision making has altered significantly in an era marked by rapid technological changes and rise of artificial intelligence. We are often confronted with decisions which require us to observe past observations and determine the best moment to act, whilst future outcomes remain inherently uncertain. Such a challenge can be framed under the 'optimal stopping problem', a scenario where one aims to maximize a reward by finding the ideal point to stop an ongoing process. These problems have a variety of real-world applications, such as making investment decisions, hiring the best candidate or timing actions within financial markets, where finding the optimal time to act can lead to rewards.

In my research, the applications of this will be explored in the context of financial markets, specifically looking at American put options, which allow the holder to exercise the option for early exercise. I focus primarily on the least squares method for estimating the optimal exercise strategy, demonstrating its use of simulation and regression techniques to improve decision making.

This approach simplifies the estimation process along with enhancing the flexibility of modelling in high dimensional settings such as financial markets - making it an effective tool for tackling complex financial problems. Explicit examples are demonstrated through simulated market conditions such as changing volatility and varying initial prices to evaluate the performance of the least squares method in estimating the optimal exercise strategy for American put options.

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Random Number Generation via Characteristic Functions

Artificial intelligence models make extensive use of statistical distributions and random sampling to predict future data. For example, large language models assign probabilities to what the next word in a sentence could be and then randomly sample one of them. This process of random variable generation is the focus of my research.

Before a random sample can be generated, we must choose a distribution to sample from. Random variables can be defined by probability mass functions or probability density functions describing the likelihoods of obtaining different results. An example is the Bernoulli distribution with only two possible outcomes such as flipping a coin to land heads or tails each with probability 50%.

The simplest and most commonly applied method of random number generation begins with a pseudo-random number between 0 and 1 where each possible result is equally likely (this is called a uniform distribution). This number is then transformed to the desired distribution via the inverse cumulative distribution function. For certain distributions this is inefficient, an important con- sideration for artificial intelligence models which require a large quantity of samples. Alternative methods of generating random numbers more efficiently will thus be highly applicable in the coming age of adaptive change and artificial intelligence.

The specific alternative method explored utilises the characteristic function which defines a random variable but has a less intuitive interpretation compared to the probability mass function or the probability density function. Simulations are used as a basis of comparison with the standard method of generating random numbers.

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Subjective and Objective Sleepiness in Insomnia, Non-Restorative Sleep, and Healthy Controls

Non-restorative sleep (NRS) is a condition characterised by subjectively unrefreshing sleep despite normal sleep duration, leading to daytime fatigue and reduced quality of life (Roth et al., 2010). Despite the significant impacts of the disorder, it does not have established diagnostic criteria and is poorly understood, leading to diminished health outcomes for individuals. It has previously been treated as a subtype of insomnia disorder (ID) due to the similarity of daytime impacts, however NRS is not associated with the sleep difficulties associated with ID (American Psychiatric Association, 2013). This study aimed to examine differences in subjective and objective sleepiness upon awakening in a sample of a sample of 33 age- and sex-matched participants with NRS, ID, and healthy controls.

This study found no significant group differences in self-reported subjective sleepiness upon awakening measured using the Karolinska Sleepiness Scale (KSS). Using high-density electroencephalography (HD-EEG) objective sleepiness was measured through alpha attenuation coefficient (AAC) and slowing ratio (SR), and was not associated with significant group differences. Additionally, there was no significant association or interaction between subjective and objective sleepiness across groups. These results suggest that within our sample, individuals with NRS and ID do not differ significantly from healthy controls on measures of sleepiness upon awakening, despite daytime impairments.

The absence of significant differences highlights the need to explore other factors contributing to NRS, such as fatigue and subjective sleep quality. Understanding these factors may aid in developing diagnostic criteria and effective treatments for NRS, ultimately improving outcomes for those affected.

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Therapeutic Effects of Naturalistic Hallucinogen Use on OCD Symptoms: A Retrospective Analysis

There is an emerging body of evidence suggesting that hallucinogens such as classical psychedelics and ketamine may mitigate some of the impairing symptoms of obsessive compulsive disorder (OCD). Despite promising early findings, preclinical and clinical evidence remains limited, and little is known about the factors influencing the extent of symptom improvement.

To investigate the impacts of hallucinogens on OCD symptoms, the current study proposed four hypotheses: (1) individuals meeting clinical criteria for OCD will report significant improvement in symptoms following their use of hallucinogens; (2) the type of hallucinogen will influence reported effectiveness in reducing symptoms; (3) the frequency of hallucinogen use will partly account for changes in OCD symptoms beyond demographic and illness factors; and (4) cognitive flexibility and insight gained during hallucinogen use will partly account for changes in OCD symptoms. To test these hypotheses, we designed a retrospective online survey, recruiting 92 participants from the general population who met clinical criteria for OCD and had prior naturalistic hallucinogen use.

Results supported hypotheses one and four, with participants reporting symptom reduction on multiple validated measures of OCD. These reductions were relatively consistent across all hallucinogen classes, suggesting a potential common mechanism. Demographics, illness related variables, and frequency of hallucinogen use did not predict the changes in OCD symptoms. Insights and cognitive flexibility emerged as significant predictors of symptom reduction.

Overall, these findings indicate that hallucinogens may serve as a viable alternative treatment for alleviating OCD symptoms. While the results point toward positive clinical outcomes, these findings relied on retrospective reports from self-selected participants. Future investigations would benefit from prospective designs and further exploration of the role of cognitive flexibility and insights gained from hallucinogen use in driving symptom reduction.

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Detecting the age and the blood-feeding history of Aedes aegypti using a portable near-infrared spectrometer (NIRvascan) and AI-based machine learning algorithms

Background and aims: *Aedes aegypti* is the primary vector Dengue, Chikungunya, Zika and yellow fever. Dengue currently affects half of the world population with no effective vaccines or drug therapies. This highlights the importance of vector control. However, assessing the effectiveness of vector control interventions is crucial. To assess the effectiveness of vector control programs, parameters such as mosquito age and blood feeding history are assessed.

Near-infrared spectroscopy (NIRS) technique is one of the techniques used for this purpose. However, to date, only benchtop spectrometers have been utilized. Although accurate for age prediction, benchtop spectrometers are costly for programmatic surveillance. Here we assessed the capacity of a portable NIR spectrometer (NIRvascan) for predicting the age and blood-feeding histories of lab reared *Ae. Aegypti* mosquitoes.

Method: Lab reared *Ae. Aegypti* mosquitoes at 1d, 10d and 17d old mosquitoes that were either unfed, blood fed once or blood fed twice were scanned with a NIRvascan and artificial neural networks was used to predict the age and blood feeding histories of mosquitoes.

Results: The model predicted the age of mosquitoes into young (< 10 days old) and old (>10 days) with a predictive accuracy of 86.7& (N=286). Blood feeding history was predicted into mosquitoes that have previous fed or not fed on blood with a predictive accuracy of 74.3% (N-316).

Conclusion: We show for the first time that NIRvascan can predict the age of mosquitoes and their blood feeding history with predictive accuracies comparable to the Labspec spectrometer. However, field testing is recommended.

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Exploring the Role of MHealth Technologies and Doctor-Patient Communication Styles for Women with Pre-existing Diabetes: A Qualitative Review

Background and aims: Pre-existing diabetes during pregnancy predisposes the woman and child to multiple health concerns such as preeclampsia, congenital anomalies, and respiratory distress. As adaptive technologies and artificial intelligence (AI) powered tools become more integrated into healthcare, the role of mobile health (mHealth) technologies has expanded. There has been a recent rise in technology available for preconception care (PCC) in pregnant women with pre-existing diabetes. Particularly given the disease's complexity and requirement for regular monitoring and constant adjustments to treatment regimens. This review aimed to explore the effectiveness and experiences of women utilizing these tools in the context of evolving healthcare technology.

Method/process: Qualitative literature of pregnant women with pre-existing diabetes and digital technology was reviewed using OvidMedline and Embase. A 5-year timeframe was applied to ensure relevance of the study.

Results/findings: MHealth was well received by the women due to its easy access including in remote settings. The other tools evaluated included insulin pumps, glucose meters, and continuous glucose sensors. Suggestions were proposed for improving personalisation and usability to better address individual needs, while retaining goal setting features to instil accountability. Communication and preconception care with healthcare professionals were reportedly associated with longer consultation times, greater opportunity to address misconceptions, and disregarding of an authoritarian tone.

Conclusion/implications/directions for future research: There needs to be a reconceptualization of PCC involving mHealth tools to better address specific concerns and to enhance doctor-patient relationships. Further studies must incorporate a large sample size, with varying commodities present in pregnant women to understand the universal applicability of evolving technology and tools.

Keywords: T2DM, T1DM, Preexisting Diabetes, Pregnancy, Preconception care, mHealth

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The Effectiveness of a Video-Based Anti-Stigma Intervention for Reducing Stigma Toward Borderline Personality Disorder

Background and aims: Extant research supports video-based anti-stigma interventions as effective, accessible solutions toward reducing mental illness stigma. Yet, despite the profound stigma associated with Borderline Personality Disorder (BPD), corresponding video-based anti-stigma interventions remain under-researched. Additionally, factors unique to the interpersonal stigma associated with BPD, which may influence the success of anti-stigma interventions, are also under-examined. This study therefore investigated the effectiveness of a video contact intervention, and the role interpersonal factors, in reducing BPD stigma.

Method/process: Australian adults (*N* = 115) were randomly allocated to one of two experimental conditions (relatable-disclosure and disclosure-only) or a control, each involving two short videos. In both experimental conditions, the second video depicted a target woman disclosing her lived experiences of BPD, recovery and stigma. In the relatable-disclosure condition, the first video involved the same target sharing personal, relatable information. Experimental participants completed measures of interpersonal responses toward the target, i.e., likability and perceived similarity, and all participants completed measures of stigma.

Results/findings: Significantly lower stigma was observed in the experimental conditions compared to the control, but no significant differences were found between the two experimental conditions, in stigma or likability and similarity. Further, neither likeability nor similarity were found to have mediated the relationship between the difference in experimental conditions and stigma. However, target likability was found to have a stronger association with lower stigma than similarity.

Conclusion/implications/directions for future research: Results will inform future research as well as the design and implementation of anti-stigma interventions for BPD through video, and other forms of emerging communications.

Keywords: anti-stigma interventions, borderline personality disorder, intergroup contact, mental illness stigma, social contact

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Surface Modification – Paving the Way for Safer Medical Implants

Biofilm formation on medical devices accounts for 65% of healthcare-related infections, and a great concern to patients and healthcare system due to defence mechanisms of biofilms and high levels of antibiotic resistance. A promising strategy to prevent bacteria colonization on medical devices is to use functionalized surfaces with antimicrobial agents (Contact-killing mechanism).

This project aims to engineer a novel material surface which can be used to combat this issue in medical implants through surface modification with Nisin, an antimicrobial peptide (AMP). Plasma polymerization technique is utilized to deposit substrate with acrylic acid, followed by coating of Nisin through physical adsorption and covalent bonding method. Surface characterization including X-ray Photoelectron Spectroscopy, Ellipsometry, Water Contact Angle and Optical Profilometry confirms successful coating through changes observed in atomic composition, thicknesses, surface wettability and surface roughness. Findings of this project can serve as a base to prepare engineered surfaces, whose anti-biofilm effectiveness will be further investigated in the future.

Jade L. K. Upton, School of Biomedical Sciences, The University of Queensland

Modifying The Predicted Secondary Structure of Huntingtin Exon 1 N-terminal Sequence Influences Its Aggregation and Neurotoxicity

Background and aims: Huntington's disease is an inherited neurodegenerative disease caused by a CAG repeat expansion in huntingtin's first exon above a critical threshold which encodes a long glutamine tract. This study investigated how changes to the predicted secondary structure of the N-terminal 17 amino acid domain preceding the polyglutamine tract in mutant huntingtin influenced aggregation dynamics and toxicity in vivo.

Method/process: We expressed mutant huntingtin exon 1 (HttQ96) containing amino acid changes in the N-terminal domain designed to alter certain features of the predicted alpha-helix region in *Caenorhabditis elegans* VD and DD motor neurons. A GFP tag enabled in vivo microscopic imaging of the toxic protein during aging. We imaged worms at larval stage 4 and adulthood day 5 to assay the toxicity of the modified proteins to neurons. We also used microscopy to count the number of GFP positive puncta in neurons at larval stage 4 and day 3 of adulthood to study aggregation dynamics.

Results/findings: We found that changing the predicted secondary structure of the N-terminal alpha helix altered aggregation and neurotoxicity of HttQ96. Modifications that resulted in increased neurotoxicity of HttQ96 that did not correlate with aggregation.

Conclusion/implications/directions for future research: The secondary structure of domains of huntingtin not containing the causative mutation is highly influential to its pathological aggregation and toxicity. In the future, accurate, efficient structural prediction with AI technologies such as AlphaFold will be highly useful in the study of neurodegenerative disease proteins given the role of structure in aggregation and toxicity.

Jaime Vanek, School of Science, Computing and Engineering Technologies, Swinburne University of Technology

Developing Stem Cell Models for Oligodendrocytes to Study Neurodegenerative Diseases *In Vitro*

Background and aims: Demyelinating diseases impact a significant amount of the population where treatments and *in vitro* research are limited in their ability to treat these diseases due to a lack of human oligodendrocytes available.

The emerging field of regenerative medicine for specific therapeutic research has created a novel method to derive oligodendrocytes *in vitro*. Therefore, this project aimed to develop a doxycycline inducible oligodendrocyte cell line in hPSCs by CRISPR/Cas9 gene editing, specifically targeting the AAVS1 safe harbor site for controlled differentiated into oligodendrocytes.

Method/process: CRISPR/Cas9 was used to successfully generate a dox inducible hPSC containing the SON. The generated H9 SON cell line was differentiated, and the morphological changes were observed. Lastly, preliminary characterisation was performed using immunocytochemistry.

Results/findings: Oligodendrocyte transcription factors containing cells lines were successfully generated where cells underwent differentiation and had morphology similar to those described in literature however, more characterization is required to determine the true identities of differentiated populations

Conclusion/implications/directions for future research: This project showed the potential of using CRISPR/Cas 9 gene editing to stably integrate the SON transcription factors into the AAVS1 safe harbor site for controlled expression via a dox inducible promoter. Thereby creating a promising alternate by avoiding other commonly used gene editing techniques such as lentivirus and their associated disadvantages. This method has possible future applications in modelling demyelinating diseases, pharmacological screening and cell replacement therapy.

Premjai Vongvises, Faculty of Science, The University of Sydney; Shelley Wickham (supervisor), Faculty of Science, School of Chemistry, School of Physics, Sydney Nano Institute, The University of Sydney

Astrobubble: Modulating Immune Responses in Space with DNA Origami Nanostructures

Background/aims: As humanity pushes the boundaries of space exploration, one of the most critical health challenges for astronauts is the deterioration of the immune system in space. We aim to solve this by engineering a DNA origami nanostructure designed to modulate immune responses dynamically. DNA origami is a technique where DNA strands are folded into specific nanoscale shapes. Inspired by pre-existing designs using the Hoberman circle, our therapeutic device is engineered to transition between open and closed states triggered by stimuli such as radiation or chemical signals. CpG oligonucleotides — short DNA sequences known to influence immune activity – will be attached to the device, and their spacing will change with device transitions.

The objective is to create a nanodevice that navigates the bloodstream and precisely modulates immune function by manipulating CpG spacing. This DNA origami-based system will present significant advancements in biomedical engineering and increase our knowledge of immune system regulation.

Method/process: Literature reviews will be conducted with the aim of finding similar nanostructures that can be used as bases for models. Next, these structures will be reproduced using the DNA design software CadNano. Unique changes will then be made to DNA design, which aim to test with OxDNA computer simulations to ensure its robustness and function. Finally, use transmission electron microscopy (TEM) for verification of the structure and fluorescence measurements to show shape changes of the structure.

Results/findings: TEM result and software simulation shows that the structure was successfully produced and can function as the purpose of its design.

Future research: Test in human serum or simulation of blood vessel to see its reaction toward human immune system.

Abbey B. Waddington, School of Biomedical Sciences, Faculty of Medicine, The University of Queensland

Spatial Mapping of Epithelial and Immune Cell Dynamics in the Gut Mucosa

The advent of artificial intelligence (AI) has revolutionized image analysis, transforming previously manual cell counting functions into fully automated processes. Our study focused on mapping cell populations and interactions in the gut mucosa via 3D confocal microscopy and immunofluorescence, contributing to the limited research on 3-dimensional cell dynamics. This provides a crucial baseline for fundamentally assessing the accuracy of AI-driven technologies.

Utilizing C_e3D-enhanced tissue clearing method, we achieved significantly greater depth of imaging in the gut mucosa, enabling a more detailed understanding of the dynamics of various critical mucosal immune cells. These included Th17 cells, $CD3^+$ T cells, and $Ror\gamma t^+$ ILC3 cells. We modelled follicular Peyer's patch regions via B cell markers in Imaris, an image analysis software, demonstrating the clustering of immune cells in the follicular regions of the mucosa. Notably, we discovered a higher density of ILC3 in the colon unexpectedly, compared to both the small intestine and Peyer's patches. However, the compliance of both the small intestine and Peyer's patch results to current literature supports their accuracy.

Our understanding can be further enhanced by AI, including the recently developed Imaris image segmentation tools. These advancements have potential for critical applications in mucosal cell targeting for therapeutic effect in intestinal disease like bowel cancer and inflammatory bowel disease (IBD).

Patrick Wang, School of Biomedical Sciences, Faculty of Science, The University of Queensland

Targeting the leading cause of vascular dementia: 40Hz visual stimulation as a possible therapeutic for cerebral small vessel disease

Cerebral small vessel disease (cSVD) is characterised by sporadic cerebrovascular lesions that affect the arterioles, capillaries and small veins supplying the brain. Over time, this results in damage to the long-range white matter tracts within distributed brain networks. This can lead to a deprivation of hippocampal-cortical communication that interrupts the hippocampus' ability to coordinate different cortical areas, leading to cognitive dysfunction and vascular dementia.

Previous studies have shown that 40Hz visual stimulation can improve neuroplasticity, reduce neuronal and synaptic loss and decrease neuroinflammation but it is unknown whether it may improve hippocampal-cortical communication. Here, we quantified hippocampal-cortical communication by correlating cortical activity recorded by wide-field calcium imaging with hippocampal activity recorded by vivo electrophysiology in awake head-fixed GCaMP6 mice which have been injected with fluorescent microspheres in the left internal carotid artery, to recapitulate cSVD. Following the injection, mice received either 40Hz visual stimulation or no stimulation.

Principal components analysis indicated that 40Hz visual simulation significantly increased right hippocampal communication with the cortical left hemisphere. Further regional comparisons showed greater right hippocampal communication in the extrastriate visual regions of both hemispheres and the secondary somatosensory, secondary motor, anterior cingulate and primary visual cortices of the left hemisphere. We also characterised bead distribution via immunohistochemistry, however, there was no difference in bead distribution between groups or hemisphere. These results suggest that 40Hz visual stimulation may help to improve hippocampal-cortical communication following microinfarcts in the hippocampus and may represent a viable treatment option for cSVD.

Sara Wardak, Charles Perkins Centre; School of Nursing, Faculty of Medicine and Health, The University of Sydney; Alice Motion, School of Chemistry, Faculty of Science, The University of Sydney; Fahad Ali, School of Life, Earth and Environmental Sciences, Faculty of Science, The University of Sydney; Stephanie Partridge, School of Nursing, Faculty of Medicine and Health, The University of Sydney

Equitable Genomics: A framework for improving access in the age of AI to clinical genomic services for culturally and linguistically diverse communities in New South Wales, Australia

Background/aims: Accessing genetic information and clinical genetic/genomic services (herein referred to as CGS), the foundation of precision medicine forming the future of healthcare (which will likely be integrated with AI), remains elusive for culturally and linguistically diverse (CALD) communities, who also experience worse health outcomes. Standard CALD health equity policies are inadequate for genomic healthcare. With almost half of Australians in 2016 being born overseas or having one/both parents born overseas, all genomic healthcare must be culturally competent. The Australian Government plans to establish a new Commonwealth body, Genomics Australia, including CALD communities in the "implementation of effective and appropriate measures to improve patient access to clinically supported genomic health technologies in an efficient, ethical, equitable and nationally cohesive way". I aimed to address this by creating a framework to assess CALD access to CGS.

Method: I inductively thematically analysed existing NSW, Australian and international policy frameworks, implementation plans, and declarations relevant to CGS using NVivo 14, Microsoft Excel and OneNote.

Findings: From the policy analysis, I created a CALD Genomic Access Framework which, in summary, asks:

1. Does the community trust clinical genomic services?
2. Are clinical genomic services equitable and accessible?
3. Is the patient supported in their position in engaging with the genomic healthcare team?
4. (Throughout) are CALD communities included as equal partners at all stages of engagement with the genomic healthcare system?

Conclusion: Because CGS will likely form the future of healthcare in increasingly multicultural Australia, my framework can be used deductively to comparatively analyse future/other jurisdictions' policies, or as a checklist for the future Genomics Australia to improve access to CGS for CALD communities. This is vital in a future where genomic data (one of the most sensitive forms of information) will become integrated with AI (often trained on non-diverse data) for diagnostics.

Zoe R. Warland, Alec W. Welsh, Samantha Thomas, UNSW Sydney, School of Women and Children's Health, The University of New South Wales

Evaluation of Regional and Global Placental Perfusion in the Third-Trimester Fetus

Background: Placental insufficiency is the leading cause of preventable stillbirth, associated with critical conditions such as intrauterine growth restriction (IUGR). Current tools cannot effectively screen for altered placental haemodynamics before fetal compromise. Our group has validated Three-Dimensional Fractional Moving Blood Volume (3D-FMBV) to measure perfusion in whole third-trimester placental ultrasound (US) volumes. This study aimed to evaluate regional and global placental perfusion, quantify its heterogeneity and changes throughout gestation, and examine differences in IUGR pregnancies.

Methods: This single-centre, prospective cohort study included 36 third-trimester singleton pregnancies with anterior placentas; 27 healthy, 8 IUGR and 1 longitudinal case. Multiple 3D Power Doppler (PD) US volumes were stitched and manually segmented to calculate the entire placenta's regional average and global 3D-FMBV. A coefficient of variation (CoV) was introduced as a novel index for the heterogeneity of perfusion.

Results: This study demonstrated that regional and global perfusion in healthy placentas increased and became more homogenous with advancing gestation. Correlation coefficients were 0.43 ($p=0.03$), 0.32 ($p=0.11$) and -0.22 ($p=0.27$) for regional average, global 3D-FMBV and CoV respectively. In IUGR cases, regional ($p=0.04$) and global ($p=0.17$) perfusion was greater but declined with increasing gestation. They demonstrated increased homogeneity ($p=0.03$), reduced cord insertion 3D-FMBV ($p=0.02$), increased peripheral 3D-FMBV ($p=0.22$) and smaller volumes ($p=0.01$).

Conclusions: This study, for the first time, quantified and visualised placental perfusion and its heterogeneity. Novel differences in IUGR cases indicate its potential as a screening tool. Future work will explore automating our method and evaluating larger cohorts to define normal perfusion ranges.

Tony Wen, School of computer science, Faculty of Engineering, The University of Sydney

A survey of data-driven methods for battery health estimation

Battery health estimation plays a crucial role in modern energy storage systems, particularly in electric vehicles and grid applications. This comprehensive review systematically analyzes the recent advances in data-driven methods for battery state of health (SOH) estimation. We first categorize the existing approaches into three main groups: traditional machine learning, deep learning, and hybrid methods. The review examines various techniques, including support vector machines, random forests, convolutional neural networks, and recurrent neural networks, analyzing their advantages and limitations in SOH estimation. Special attention is given to emerging trends such as transfer learning and physics-informed neural networks, which address the challenges of data scarcity and model interpretability. We also discuss critical technical aspects including data preprocessing, feature engineering, and uncertainty quantification.

Through comparative analysis, we identify that hybrid approaches combining data-driven methods with domain knowledge demonstrate superior performance in terms of accuracy and generalization. Furthermore, we highlight existing challenges, including data quality standardization, computational efficiency, and real-time adaptation capability. Finally, we provide insights into future research directions, emphasizing the potential of small-sample learning and online adaptive algorithms. This review serves as a comprehensive reference for researchers and practitioners in the field of battery health management.

Jaden A. White, Daniel Costa, School of Psychology, Faculty of Science, The University of Sydney

Understanding How People Use Unidimensional Pain Scales: The Factors Influencing Simple Pain Ratings

Pain is often measured using unidimensional pain intensity scales. Although, pain is typically conceptualised as multidimensional, encompassing sensory, emotional and cognitive-evaluative dimensions (Melzack, 2005). This study experimentally demonstrates the multidimensionality of pain ratings, revealing that people think beyond just pain intensity to also consider pain-related distress and interference when rating their pain.

Using a numerical rating scale, participants rated hypothetical pain reports significantly higher when higher levels of distress and interference were reported. Participants placed equal importance on distress and interference as on pain intensity when making a pain rating. These findings challenge the assumption that unidimensional scales solely reflect pain intensity; individuals naturally integrate these additional dimensions into their pain ratings. We also provide further evidence that it is problematic to interpret pain scale data as ratio- or interval-level data. Our replication of the Personal Pain Scale Task (Bosdet et al., 2021) provides evidence against the interpretation of Verbal Pain Scale ratings as ratio- and interval-level data. Thematic analyses of participants' short answers to qualitative prompts revealed idiosyncratic conceptualisations of rating pain. Participants often found single ratings insufficient, requesting more context for meaningful interpretation and reporting difficulty in reducing pain to a single number, which raises questions about the adequacy of unidimensional pain scales and the individual variability in interpreting scale categories and anchors.

This research raises concerns about interpreting unidimensional pain scales in clinical and research settings and supports the notion that rating pain is a process of meaning-making. Future research should investigate whether multidimensional pain assessments offer a more accurate representation of patient experiences.

Nathan Wise, School of Science, Western Sydney University.

The Precipice of Plant Nitrogen Acquisition: A Phenotypical Investigation into the Effects of Small but Mighty Signalling Peptides

This presentation explores the role of peptide hormones in plant nitrogen (N) acquisition, assimilation, and root architecture. Nitrogen, a crucial nutrient for plant growth, is primarily absorbed as nitrates through root-soil interactions. Due to the high solubility of inorganic nitrates, soil N levels can fluctuate, affecting the availability of bioavailable N.

In *Arabidopsis thaliana*, C-terminally encoded peptides (CEPs) are vital in regulating root architecture in response to varying soil N levels. *CEP* genes are expressed in root tissue under nitrogen limitation, travel to shoot tissue via the xylem, and interact with CEP receptors (CEPR1). Recent studies have shown that interactions between CEP1 and CEPR1 induce the expression of CEP DOWNSTREAM 1/2 (CEPD1/2), which influences nitrogen transporter expression and aids in N uptake.

Our research included phenotypic analysis of *Arabidopsis thaliana* loss-of-function double mutant cepd1/2, revealing an unexpected early flowering phenotype. This suggests that these signalling networks are more complex than previously understood.

Overall, this research provides new insights into the role of peptide hormones in plant nitrogen acquisition and flowering time, highlighting the complexity of signalling in seed plants in response to varying soil nitrogen concentrations and enhancing our understanding of these processes.

Stephanie MacMahon, School of Education, Faculty of Humanities, Arts and Social Sciences, The University of Queensland; **Valerie Wong (Li Qing),** School of Music, Faculty of Humanities, Arts and Social Sciences, The University of Queensland

Exploring Teacher Professional Identity in a Digitally Transforming Landscape

As the educational landscape evolves with the integration of artificial intelligence and digital technologies in classrooms, understanding teacher professional identity becomes crucial for effectively supporting educators. This literature review, conducted as part of a four-week Winter Scholars project, investigates the definitions, dimensions, and factors that influence teacher professional identity.

The findings reveal that a well-developed professional identity significantly enhances teachers' adaptability, job satisfaction, and commitment to innovative pedagogical practices. Additionally, teachers with strong professional identities are more likely to successfully integrate new technologies into their teaching. These insights underscore the importance of educational policies and practices that foster the development of teacher professional identity, which in turn enhances teaching efficacy and student learning outcomes amidst ongoing digital transformation.

This review is part of a larger project investigating the impact of a year-long research-practice partnership on teacher professional identity conducted by the UQ Learning Lab, contributing to broader discussions on enhancing teacher efficacy and adaptability in a dynamically changing educational environment.

Jinyang Yang, School of Biomedical Science, Faculty of Science, The University of Queensland; Natasha Reid, Jayden Logan, Khari Garavelis, Nicole Hayes, Child Health Research Centre, Faculty of Medicine, The University of Queensland; Lisa Akison, School of Biomedical Sciences, Faculty of Medicine, The University of Queensland; Chelsea Vanderpeet, Karen Liddle, Maree Maloney, Emily Sullivan, Child Health Research Centre, Faculty of Medicine, The University of Queensland; Karen Moritz, School of Biomedical Sciences & Child Health Research Centre, Faculty of Medicine, The University of Queensland

Renal and Cardiovascular Function in Children with FASD: Links to Food Approach and Avoidance Behaviors

Background: Fetal alcohol spectrum disorder (FASD) is associated with a range of developmental, behavioral, and physical impairments. While much research to date has focused on developmental and behavioral aspects of FASD, there is growing evidence that children with FASD can experience alterations in renal and cardiovascular function.

Methods: In this study we recruited children and adolescents (n = 53) with and without a diagnosis of FASD. We assessed a number of cardiovascular and renal outcomes and collected caregiver data from questionnaires to assess how these factors may relate to eating behaviors.

Results: Compared to typically developing participants, those with a diagnosis of FASD had significantly elevated urine sodium (Na^+), sodium-to-potassium (Na^+/K^+) ratio, and a loss of the normal age-associated rise in urine creatinine. The FASD group also exhibited significantly elevated resting heart rate without a corresponding change in BP. A number of measures of food approach and avoidance subscales on the Children's Eating Behavior Questionnaire (CEBQ) were significantly elevated in those with FASD compared to controls.

Conclusions: Together these findings suggest that renal and cardiovascular function may be altered in children and adolescents with FASD, which may be linked to abnormal food-related behaviors. While these early life physiological changes are not fully understood, it is likely they contribute to poorer long term health outcomes in those exposed. These data also highlight the need for targeted interventions addressing both the metabolic and behavioral aspects of FASD. Further research is needed to explore the underlying mechanisms and potential long-term implications of these findings.

Bailey E. Yoshia, School of Psychological Sciences, Faculty of Medicine, Health and Human Sciences, Macquarie University; Dr. Lynlee Howard-Payne, School of Psychological Sciences, Faculty of Medicine, Health and Human Sciences, Macquarie University

We Can Live and Adapt: An Interpretative Phenomenological Analysis of Carers' Outpatient Anorexia Nervosa Treatment Experiences

Anorexia nervosa (AN) is a serious condition that demands high levels of carer support due to its complex psychological, physical, and social impacts. Carers must continually adapt to the emotional and psychological challenges of caregiving. Although multidisciplinary outpatient treatment (MDOT) is a recommended approach for AN recovery, little research explores how carers adapt within this model.

This study aimed to understand the lived experiences of carers of individuals receiving MDOT for AN. Five participants were recruited from a treatment centre in Sydney, Australia. Semi-structured individual interviews were transcribed verbatim and analysed using Interpretative Phenomenological Analysis (IPA) within a critical realist framework. Three master themes emerged: (1) The Role of MDOT, (2) Emotional and Psychological Consequences of Caregiving, and (3) Coping Strategies and Resilience.

Findings highlight the evolving adaptive processes carers experience as they navigate the structured support of MDOT while managing emotional burdens such as stress, anxiety, and guilt. Carers employed various coping strategies and demonstrated resilience, adapting to both the expectations of MDOT and their own personal needs. These insights reveal that adaptation is an ongoing, multifaceted process for carers, shaped by the nature of their caregiving role and the support provided by MDOT. We suggest improvements in MDOT approaches, focusing on enhancing carers' adaptive capacities to reduce their emotional burden and improve both carer well-being and patient recovery outcomes.

Diane J. Young, Ali Shokoohmand, School of Chemical Engineering, Faculty of EAIT (Engineering Architecture and Information Technology), The University of Queensland

The Impact of Synthetic Heparan Sulphate on Adipose-Derived Stem Cells

A major challenge in current cell manufacturing processes for cell therapy applications is expanding cells to large quantities without compromising the therapeutic efficacy of the cells, which tends to decrease as cell numbers increase. To address this bottleneck in cell manufacturing and the growing demands of modern society, it is crucial to identify methods that can enhance cell proliferation while slowing cellular aging. Heparan sulphate (HS) is a naturally derived polysaccharide known for its role in stem cell proliferation and adhesion and may improve the current challenges of cell manufacturing. However, naturally derived HS is costly and challenging to scale. Traditionally, cell manufacturing for therapies like blood cancer treatment faces limitations due to the high costs and reduced efficacy when expanding cells to large numbers.

In order to address this limitation, synthetic HS mimetics were developed. We hypothesise that synthetic HS mimetics could enhance mesenchymal stem cell proliferation and delay cellular aging, achieving effects similar to or greater than those observed with naturally derived HS. Candidate mimetics were selected based on previous binding affinity data, and various concentrations were tested using cell-based assays and western blot analysis. Specific synthetic HS mimetics significantly increased cell proliferation, outperforming naturally derived HS across multiple proliferation markers. However, other mimetics exhibited cytotoxicity at specific concentrations.

Efficient cell manufacturing remains a challenge even in contemporary society. This work demonstrates the potential of synthetic HS mimetics to improve cell manufacturing efficiency for therapeutic applications, especially in tissue engineering and regenerative medicine.

Yaxin Zheng, College of Business and Economics, Australian National University

Transforming Australia's Lending Sector: Unveiling Key Drivers and AI-Driven Innovations

This study explores the evolving landscape of the lending sector in Australia's financial market following the rise of AI technologies. By conducting a statistical analysis of lending indicators sourced from the Australian Bureau of Statistics, this research identifies the drivers of change in the sector, particularly as Australia transitions to a more cosmopolitan market environment. The findings reveal that AI-driven tools have significantly impacted the Australian lending market. The study highlights key factors influencing the sector's transformation and provides strategic recommendations for the Australian government to leverage AI technologies more effectively. By doing so, it aims to enhance the sector's growth and resilience in the era of AI advancements.

Kevin Zou, School of Medicine, Faculty of Medicine and Health, The University of New South Wales

Machine Learning for Ischemic Stroke: Predicting Ischemic Core on Non-contrast CT and CT Angiography

Background and Aims: Accurate and timely identification of irreversibly injured ischemic core volumes is a key part of patient selection for acute stroke therapies. This study aimed to investigate whether an artificial intelligence (AI) model could automatically predict and segment ischemic core volumes (ICV) on computed tomography (CT) images.

Method: A U-net based AI model was trained and tested using non-contrast CT (NCCT) and CT Angiography (CTA) volumes from 86 acute stroke patients that were split into training (n = 46) and testing (n = 40) sets. Three different imaging modalities: NCCT Only, NCCT with anatomical overlays, and CTAs were spatially aligned using an internally developed co-registration tool to train three AI models.

Results: Maximum Dice scores obtained for NCCT Only, NCCT+Anatomy and CTA models were 0.56 (0.44 – 0.68), 0, and 0.70 (0.56 – 0.81) respectively. Bland-Altman analyses revealed biases of -73.1 (95% Limit of Agreement = -206.9 – 60.7) for the NCCT test set and -21.6 (95% Limit of Agreement: -131.9 – 88.7) for the CTA test set. Both NCCT Only and CTA models demonstrated high sensitivities of 0.85 (95% CI: 0.62 – 0.97) and 0.95 (95% CI: 0.82 – 0.99) but low specificities of 0.25 (95% CI: 0.09 – 0.49) and 0.05 (0 – 0.84).

Conclusion: This proof-of-concept study demonstrated the feasibility of tissue fate prediction using accurately co-registered ischemic core outcomes on CTA. The powerful co-registration tool we developed can facilitate multi-channel CNN models to drive future neuro-imaging research. Further training with larger, more selective datasets may improve the accuracy of these predictive models.

POSTER presentations

April L. Abela, Kevin R. Brooks, School of Psychological Sciences, Macquarie University

Retinotopy of the Body Adiposity Aftereffect

Misperception of the size and shape of one's body is a widespread phenomenon. Perceptual psychologists have suggested that this error may be driven by the process of visual aftereffects, whereby prolonged exposure to specific stimulus attributes results in a visual bias. The body adiposity (fat) aftereffect occurs when visual exposure or 'adaptation' to low-adiposity bodies results in subsequently viewed bodies appearing to have higher adiposity than they objectively do, and vice versa. However, it remains unclear whether the body adiposity aftereffect is driven by 'low-level' mechanisms, where stimulus attributes are processed in early stages of the visual perception neural pathway and aftereffects are restricted to the retinal location where the adaptation occurred (i.e. 'retinotopic'), or by 'high-level' processes, where attributes are processed in hierarchically 'later' stages and aftereffects can translate across retinal locations. As such, the present study aimed to investigate the degree to which the body adiposity aftereffect is retinotopic.

Participants adapted to either low- or high-adiposity bodies presented in the centre of the retina. Body adiposity ratings were measured at baseline and post-adaptation across the retina. The body adiposity aftereffect translated to test stimuli at all retinal locations tested, suggesting that the mechanisms underlying body adiposity perception are not strictly retinotopic. However, aftereffects were smaller for locations further from the centre of the retina, implying a degree of retinal specificity.

Overall, these findings suggest partial retinotopy of the body adiposity aftereffect. The present study enhances the understanding of the processes underlying body adiposity perception and offers insights into potential mechanisms driving body size and shape misperception.

Amelia R. Bevan, School of Psychological Sciences, Faculty of Medicine, Health and Human Sciences, Macquarie University

It's Those Damn Phones! Smartphone Distractions' Impact on the Continued Influence of Misinformation

As mobile phones dominate information consumption, concerns grow over people's susceptibility to misinformation. Past studies show the 'Continued Influence Effect' (CIE), where individuals report misinformation instead of corrected information, even after acknowledging and remembering that the original misinformation was retracted. This suggests people struggle to update their original memory despite successful encoding. Experiments manipulating this phenomenon found that reminders of the original misinformation help reduce its influence. However, researchers have not controlled for the effects of mobile phone distractions in these experiments.

An eye-tracking experiment was conducted with 37 university students to assess how auditory smartphone distractions impact memory updating compared to no auditory stimulus. The study also explored whether these distractions harm an individual's ability to update their memory despite explicit reminders. Repeated measures analyses revealed that auditory distractions impaired memory for the corrected information, regardless of reminders. While reminders reduced the CIE, they did not aid memory retention of correct information in the presence of distractions.

In light of these findings, educational institutions, particularly at the undergraduate level, must prioritise the development of critical thinking and media literacy skills. As AI increasingly shapes information consumption, broader society must confront the risk of misinformation shaping public opinion and behaviour.

Daniel Bruno Bonatti, School of Engineering, Design, and Built Environment, Western Sydney; Neha Deo, Dorothea Bowyer, Maria Estela Varua, School of Business, Western Sydney University.

The Promotion of Container Deposit Schemes (CDS) within an Artificial Intelligence Landscape using social media

This study undertakes a comprehensive investigation of the New South Wales Return and Earn (R&E) container deposit scheme (CDS). The purpose is to gather a deeper understanding of contemporary societies interaction, adoption and effectiveness of the scheme. The research investigates public awareness of the R&E scheme alongside gaining an understanding of initiatives that elicit behavioral change around community-based recycling programs.

Australia wide container deposit schemes are embraced. In the age of adaptive change recycling is the first step forward for a circular economy. The rise of Artificial Intelligence allows for technological disruption via social media bringing fake news, misinformation, and post truth. Thus, research-based learning skills are required to sort out the truth. Artificial Intelligence (AI) landscape of many Social Media platforms promoting the R&E scheme.

Mixed Methods approach utilized a scoping review incorporating a literature review and investigation of communication strategies. The research designs a case study focusing on thirteen Local Government Areas (LGAs) of Western Sydney. This communication experience investigated was the types of social media, Cultural and Linguistic Diversity (CALD), Diversity, Strategies, R&E website. This resulted in a comparative matrix. Evidence-based stakeholder interviews were conducted to best understand the public's behavioral change with respect to R&E.

Artificial Intelligence via social media is dividing State and Local governments garbage responsibility. Municipalities are not aligned with State governments in promotion of schemes. Municipalities' priority, in recycling, is in curbside bin collections. Moreover, social media is leading stakeholders, Community, Tomra Cleanaway and LGAs into different directions in communicating, and behaviors.

Rayne Bracey, **Noel Caguicla**, Mariam Hashemi, Long Hoang, Todd Neal, School of Science, Computing and Engineering Technologies, Swinburne University of Technology

Extraction of Essential Oil from Orange Peels and its Antimicrobial Activity

Essential oil extracted from *Citrus sinensis (orange)* peels has attracted significant interest for its antibacterial potential. With 32 million tons of orange peels discarded as waste annually, using them as antimicrobials provides an efficient way to reuse valuable resources. The aim of this study is to evaluate the effects of two different extraction methods, such as steam distillation and Soxhlet extraction, on chemical composition and antibacterial properties of essential oil.

Chemical analysis indicated that the main component of the essential oil is d-limonene. Soxhlet produced a higher yield of d-limonene but based on GC-MS and UV-VIS analysis, the extract from steam distillation was of higher purity. The antibacterial activity was assessed using the disk diffusion method against *Staphylococcus aureus (S. Aureus)* and *Escherichia coli (E. coli)*. Extracts at 25% and 75% concentrations, dissolved in DMSO, were tested. Additionally, the minimum inhibitory concentration (MIC) was determined. At 75% concentration, antimicrobial activity was observed for both bacteria, although team distillation produced a larger inhibition zone for *S. aureus* compared to Soxhlet. For both extraction methods, the MIC for *E.coli* was 100% extract, while for *S. aureus, it* was 12.5% extract. The extraction of d-limonene from *Citrus sinensis* peels repurposes waste into a valuable antimicrobial product. This research exemplifies an adaptive shift in response to dwindling resources by repurposing wastes, highlighting the need for innovative methods to produce everyday products.

Matthew J. Catanzariti, Greg T. Sutherland, Sydney Brainomics, Charles Perkins Centre, The University of Sydney

Alzheimer's Disease and Machine Learning: An Interdisciplinary Approach to Nuanced Pathology Quantification

Background: Numerous knowledge gaps exist in our understanding of Alzheimer's disease (AD). One reason for this is the technical barriers inherent to histopathological studies. For example, the conversion of information from images into numerical data is exceptionally difficult. Existing methods are imprecise, labour-intensive, and time-consuming. Additionally, they often give an incomplete picture of AD pathology. A machine learning-based workflow was developed for the automated quantification of amyloid-beta — one of two hallmark proteins that accumulate in the AD brain.

Methods: An image segmentation (U-Net) model was trained to automatically, rapidly, and reproducibly identify various amyloid-beta structures. A training dataset of 2391 images was created using manual and computer-assisted labelling. The model's performance was evaluated using various metrics, and its output was compared to that obtained from existing quantification methods. The model was then used to analyse whole slide images from a test cohort of 71 individuals (39 healthy controls, 32 AD).

Results: The trained U-Net model was robust, rapid, and scalable. The model accurately identified amyloid-beta structures, with a general accuracy score of 96%. Additionally, the model's output was highly correlated (r=0.943) with results obtained using existing methods. Finally, the model provided nuanced details about amyloid-beta structural subtypes, which existing methods had not previously achieved.

Conclusions: Automated image segmentation methods allow for the robust and rapid collection of large amounts of data. The data allows AD cases to be classified into pathological phenotypes, and when combined with molecular information, brings clinically relevant disease modifying therapies closer to fruition.

Marlowe A. Crosdale, Xu Weizhi, Liviu Bodea, Karin Borges, School of Biomedical Science, Faculty of Medicine, The university of Queensland

Limited Effect of Selenium Supplementation on Hydrogen Peroxide Toxicity in Primary Cortical Astrocyte Cultures from Healthy Rats.

Background and aims: Thyroid autoimmunity (TAI) is a disorder common in pregnant women and is associated with impaired foetal brain development partially caused by the increased production of reactive oxygen species (ROS). Glutathione peroxidase, an antioxidant selenoprotein, as well as many other selenoproteins have altered expression in TAI. We aimed to investigate the effect of several forms of bioavailable selenium on H_2O_2 toxicity in cultured cortical astrocytes from healthy rats.

Method/process: Primary cortical astrocyte cultures were established in T75 flasks and reseeded to 96-well plates as needed. We used the mitochondrial activity, thiazole blue (MTT), assay as a proxy for cell viability. After establishing H_2O_2 and selenium dosage regimes we conducted a series of dose-response experiments with sodium selenite, sodium selenate, selenocystine and selenomethionine. Data were interpreted to form dose-response curves and LD_{50} were calculated.

Results/findings: Selenite increased the LD_{50} of H_2O_2 by 1.5-fold at 100 nM, with a diminishing effect at higher concentrations. Sodium selenate, selenocystine and selenomethionine had a negligible effect on H_2O_2 LD_{50}.

Conclusion/implications/directions for future research: This single-subject study suggests limited effects of the selenium forms tested. Future research will employ metabolomic approaches to identify the specific selenium metabolites involved and elucidate the potential mechanisms underlying the lack of effect. Expanding to more complex models of induced TAI and long-term supplementation could provide further insights into the potential therapeutic benefits of selenium for neurodevelopmental changes in offspring of thyroid autoimmunity mothers.

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Human-Chatbot Relationship Development is Enhanced by Reciprocal Self-Disclosure

The possibility of humans developing significant intimate relationships with chatbots has been advanced by recent developments in artificial intelligence (AI). Although anecdotes abound of users forming relationships with chatbots, empirical accounts of such relationship development are limited. Human-human relationships and feelings of intimacy often develop through the mutual sharing of personal information (i.e., reciprocal self-disclosure).

In two experiments, we explored whether reciprocal self-disclosure also leads to human-chatbot relationship development. In the first experiment, participants engaged in a conversation task where the participant and chatbot answered a list of questions manipulated for both depth (deeply personal vs. superficially personal disclosure) and conversation length (i.e., number of questions), followed by measures of relationship development outcomes. In the second experiment, participants completed the same conversation task, but the chatbot either reciprocated or did not reciprocate in the sharing of personal information.

A mini meta-analysis across the two experiments revealed that answering deep versus superficial questions about the self, increased multiple measures of human-chatbot relationship development in users. In addition, receiving personal information from the chatbot, compared to not receiving information, increased some, but not all, of the measured relationship development outcomes (Experiment 2). Moderated mediation models examined potential mechanisms underlying these effects. However, the number of questions asked did not have any significant effects on the measured outcomes (Experiment 1). These findings indicate that human-chatbot relationships develop via similar processes to human-human relationships, suggesting that human-human relationship frameworks can be applied to understand human-chatbot relationship development.

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Unravelling the Link between Patient Physiology, Immunometabolism, and Cancer Progression

Background and aims: Developing critical research skills is essential for unravelling the complexities of tumour behaviour that cannot be fully explained using artificial intelligence. This project builds upon preliminary research from the Lipid Metabolism Laboratory which investigated the effect of macronutrient intake on breast cancer progression in BALB/c-4T1 mice. New observations revealed that metastatic burden, driven by high-carbohydrate intake, was associated with GLUT1 upregulation (Glucose transporter 1), and CD36 downregulation (Fatty acid transporter) in B and cytotoxic T lymphocytes (CTLs), suggestive of pro-metastatic conditions. This study further explores these mechanisms *in vitro* to understand how shifts in glucose and lipid metabolism affect anti-tumour immune responses.

Method/process: Immortalised mouse cell lines, A20 (B cells) and 3A9 (T cells), were cultured under various glucose and lipid environments to assess metabolic and immune function changes. To mirror the immunometabolic profile observed in high-metastatic mice, these cells were genetically modified to exhibit a GLUT1 gain-of-function and CD36 loss-of-function.

Results/findings: Varying glucose and lipid environments distinctly altered A20 and 3A9 cellular viability and metabolism, while immune function was unaffected by changes to metabolic stimuli. We have also established a foundational understanding for genetically modifying these cells metabolic phenotype.

Conclusion/implications/directions for future research: This study underscores the importance of nutrient availability in shaping immune cell function. Integrating our *in vitro* findings with our prior *in vivo* work will enhance our understanding of how host physiology influences immune responses and cancer progression. Potential future directions aim to enhance immunotherapy efficacy by identifying ‘receptive’ or ‘supportive’ tumour niches.

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Sustaining Vigilant Attention: Is It Still Challenging with Dynamic Stimuli?

With increases in semi-automated cars and transport systems, the job of the driver has changed from active to monitoring computer displays for infrequent errors. Previous research shows that maintaining vigilant attention in a task requiring infrequent responses is challenging, with performance decreasing over time (e.g., more missed targets and longer reaction times). However, most studies on vigilant attention involve static stimuli, poorly reflecting our dynamic world.

The Multiple Object Monitoring (MOM) task mimics real-world demands using dots that move towards a central collision point. Here, we manipulated the target frequency (potential collisions) of the MOM task, using 'active' (50%) and 'monitoring' (~12.5%) conditions. In a between-subjects design, participants completed one frequency condition for ~50 minutes. If performance is affected by vigilance conditions in dynamic environments, it should decrease over time on task for the monitoring group but not the active group.

We recorded reaction times for correct responses that prevented collisions, and errors (misses or false alarms). The results showed that while the active group maintained performance over time, the monitoring group showed a progressive decrease in performance over time, consistent with prior studies using static stimuli.

Overall, our findings demonstrate that even in a task with dynamic stimuli, low target frequency results in decreased performance over time. This suggests that attention is difficult to maintain under monitoring conditions, raising concerns about the increasing automation of the world around us.

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Co-designing Evidence-based Digital Patient Education Resources for Nepali-speaking People with Low Back Pain: A Step Towards Improving Equitable Care for Culturally Diverse Communities in Australia

Background and aims: In a world where the use of artificial intelligence and social media is growing rapidly, it has become increasingly important to challenge false and misleading information and harness the power of technology to make credible information accessible, especially for people from diverse cultural backgrounds. Currently, there is a lack of culturally sensitive and accessible educational resources available for culturally and linguistically diverse (CALD) individuals with low back pain. Adapting pre-existing interventions through collaboration with CALD communities would rectify this problem.

Method/process: Using experience-based co-design methodology, we conducted a series of workshops each for Nepali-speaking health professionals (n=8), researchers (n=4) and people with lived experience of disabling back pain (n=7) to gain an understanding of the key educational concepts necessary to promote understanding and self-management of low back pain, and the format in which they would like to receive / deliver educational messages.

Results/findings: The most important educational concepts were ‘why pain occurs’, and ‘how behavioural and lifestyle factors can contribute to the pain experience’. Both groups emphasised that stories from other people with lived experience of back pain can be useful in delivering these key educational concepts. Short social media style videos were suggested as the most preferred format to deliver and receive messages. Prototype development is underway which will be evaluated for acceptability and effectiveness.

Conclusion/implications/direction for future research: This project will offer a guideline for developing culturally sensitive and adaptable educational interventions, with the potential for cross-cultural adaptation in future research.

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Hemispheric Differences in Multiple Object Tracking: The Role of Temporal Frequency

The perception of moving objects and the success with which these objects can be tracked is fundamental to our visual experience. Research suggests that this ability is distinct between the hemispheres of the brain such that tracking is significantly advantaged for stimuli within the right hemifield. However, tracking is a complex perceptual ability dependent upon a number of underlying visual mechanisms for its successful execution. The present paper extended research to investigate whether or not hemispheric specialisation would be apparent when a tracking paradigm was limited by temporal frequency.

Temporal frequency refers to the rate at which objects pass a specific location within a display; as the speed of travelling stimuli increases, the flicker rate of these locations also increases until the limit of temporal frequency is reached, and tracking fails. We target temporal frequency specifically for its relationship to temporal resolution—a perceptual ability describing the rate of perceptual processing. Based upon existing theory, stimuli were designed such that the relationship between hemispheric specialisation and temporal frequency could be investigated, testing participants on their ability to track moving objects in four total conditions (Left Hemifield: 4-Objects, Right Hemifield: 4-Objects, Left Hemifield: 6-Objects, Right Hemifield 6-Objects).

Findings revealed that tracking was significantly advantaged when stimuli were presented in the left hemifield, indicating an increased processing capacity for temporal frequency by the right hemisphere of the brain. In the context of previous literature, these results are novel in suggesting that it is not tracking broadly which is distinct between the hemispheres. Instead, they purport that underlying perceptual mechanisms such as temporal frequency and speed, drive hemispheric tracking abilities.

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Novel Identification of Adolescent Non-Suicidal Self-Injury Risk: Integrating Multi Informants' Assessments of Youths' Emotional Problems

Non-suicidal self-injury (NSSI) disproportionately permeates adolescence, serving both intrapersonal and interpersonal functions of regulating affect and communicating distress. Uncertainty remains whether increased artificial intelligence (AI) and technological dependence will worsen such maladaptive mental health coping within youth, or instead improve current inadequate assessment and identification of NSSI risk patterns.

Broadly, youth mental health assessment involves parent, teacher, and youth perspectives, consistently finding discrepant informant reports of adolescent symptoms reflect adversity. However, person-centred modelling and interpretation of multi-informant divergent patterns lacks regarding NSSI risk, specifically. Hence, a secondary analysis of the Longitudinal Study of Australian Children was conducted on 3,372 youth aged 12-13 to explore relevance of multi-informant discrepancies and NSSI indicator variables to identifying youth NSSI risk.

Latent class analysis of multi-informant emotional problems ratings dichotomously classified youth: Class 1 with aligned informant ratings of normal emotional problems, and Class 2 with relative agreement patterns of heightened emotional problems ratings. While significance testing and support of expected relations to NSSI were limited by few NSSI item respondents (n = 62), exploratory data analysis found all variables indicative of NSSI presentation more pronounced in Class 2. Thus, Class 2 profiled youth NSSI risk: more depressive symptoms, less help-seeking efficacy, more parental mental health difficulties, and likely being female.

This serial cross-sectional study provides theoretical foundations to comprehensively identify youth NSSI risk through novel interpretation of multi-informant discrepancy patterns. Practically, such outlines immediate intervention paths for multi-informants, and plausibly implicates AI pattern recognition in improved future assessment, ultimately preventing escalated youth adversity.

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Leveraging NMN and AI to Improve Infertility Outcomes: Insights from Mouse Models

Background/Aim: *In vitro* fertilisation (IVF) is a widely adopted infertility treatment that involves fertilising eggs with sperm in the laboratory. Despite its widespread use, IVF success rates remain limited, highlighting the need for adaptive innovations in the process. In this era of adaptive change, artificial intelligence has opened new avenues for optimising IVF outcomes. Recent AI-based models have shown that treating eggs with a compound known as nicotinamide mononucleotide (NMN) can significantly improve egg quality, suggesting its potential to boost IVF success rates. This study investigates the impact of NMN-treated eggs on IVF outcomes in mice.

Method: Eggs were surgically retrieved from female mice and fertilised via IVF. The fertilised eggs were matured for five days with treatments of NMN and FK866 (which counteracts NMN's effects) or left untreated for comparison. After five days, the resulting embryos were scored based on their developmental stages.

Findings: Treating mouse eggs with NMN in IVF showed no effect on embryo development compared to untreated eggs. However, when eggs were treated with FK866, embryo development halted within four days, indicating that NMN is essential for normal embryo progression in IVF. This effect was reversed by reintroducing NMN, highlighting its importance for healthy embryo development.

Conclusion: These findings highlight the potential of NMN to improve human IVF outcomes and emphasise the role of AI in identifying compounds that improve infertility treatments. Future research could use a diverse mouse cohort to better represent IVF patients and leverage AI-guided models to further refine IVF processes.

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One Body, Two Identities': A Preliminary Examination of the Role of Bicultural Identity on Body Image Concerns

Background and aims: Body image concerns are acknowledged as a prominent problem amongst young women in contemporary society, in particular, social media use has found to exert detrimental influences on their body image. The study investigated the association between social media use and body image dissatisfaction and mood amongst bicultural individuals. More exploratorily, the study examined how facets of bicultural identity may influence associations between social media use and body image concerns in the current digital age.

Method/process: Undergraduate bicultural Chinese-Australian women (*N* = 76) who were daily users of social media completed baseline survey measures in the lab, from them, participants (*N* = 74) then commenced an ecological momentary assessment by completing an online survey at semi-random intervals four times a day for seven days.

Results/findings: On the trait level, the study found that internalising the pale skin ideal to a greater extent than the tanned skin ideal predicted skin-tone dissatisfaction. For those who spent more time on social media, experiencing greater cultural identity conflict predicted more appearance comparison tendencies. On the state-level, upward appearance comparisons were associated with worsened mood, in particular, cultural identity conflict and self-concept clarity independently predicted adverse outcomes in daily life.

Conclusion/implications/directions for future research: The present research establishes a preliminary framework for future research to capture a more complete understanding of body image concerns in contemporary society. Furthermore, the current research demonstrates the relevance of individual differences in one's bicultural identity to their body image and mood in daily life, posing a new pathway to be explored in relation to social media use and body image outcomes. Together, the study serves as an initial step in disentangling the mechanisms that contribute to body image concerns among young bicultural women in the present digital age.

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Relationship between trial design and outcome effects in knee osteoarthritis: A pilot systematic review of randomised controlled trials s investigating exercise

Background and aims: To explore the relationship between trial design on the efficacy to effectiveness spectrum and the effectiveness of exercise interventions for people with knee osteoarthritis (KOA) in a pilot sample of randomised control trials (RCTs).

Method/process: A pilot systematic review based on a draft PROSPERO systematic review protocol. We identified RCTS that investigate exercise for KOA from a preexisting review, and extracted data (descriptive characteristics, standardised pain and physical function treatment effect sizes) from the selected RCTS. The Rating of Included Trials on the Efficacy-Effectiveness Spectrum (RITES) tool (scored from 4 to 20; 4 = a strong efficacy trial design and 20 = a strong effectiveness trial design) was used to assess trials on the efficacy-effectiveness spectrum. The relationship between RITES score and treatment effect size was explored using scatterplots.

Results/findings: 18 eligible RCTs were included. The total RITES score of included trials ranged from 5 to 19. Discussion of RITES scoring between researchers often led to score modification. A positive association trend between pain and function effect sizes and efficacy design was seen on scatterplots.

Conclusion/implications/directions for future research: The effect sizes from exercise interventions investigated in trials with a stronger emphasis on efficacy may be larger than from trials with an emphasis on effectiveness. However, since the number of trials that we reviewed was limited, these exploratory findings require investigating in a comprehensive systematic review.

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Analysis of Kidney Impairment in Metabolic Syndrome

Metabolic syndrome (including prediabetes/insulin resistance) has been observed to increase the risk of diabetes mellitus, which results in advanced complications such as kidney disease. Diabetic Kidney Disease (DKD) is a chronic kidney condition due to microvascular complication in diabetes. DKD is characterised by progressively declining glomerular filtration rate, increased urinary albumin excretion and diminished renal function. These measurements however only capture pre-existing damage in the kidneys, and not early signs of kidney pathogenesis. Similarly, current trials with RAAS and SGLT2 inhibitors have portrayed potent benefits in reducing risk of diabetic complications; however, residual risk of DKD progression and renal failure remains. Knowledge of the underlying molecular mechanism in metabolic syndrome leading to kidney pathogenesis is lacking. Our study aim was to examine the proteomic differences and use both traditional and machine-learning (ML) analyses for identifying biomarkers associated with metabolic syndrome kidney pathogenesis.

For 23-weeks, mice (n=10 animals/group; 50% females) were fed either chow (control), high fat diet (HFD), or yo-yo (oscillating between HFD and chow fortnightly) diet (both models of metabolic syndrome). Kidneys were dissected at endpoint and used for histological assessment and untargeted proteomics via Mass-Spectrometry, generating a large dataset.

Our analysis identified significantly higher levels of proteins (Notably Rab31 and Ubxn6) associated with different metabolic pathways, in both oscillating and HFD groups. Application of statistical analysis including ML on the large proteomic dataset, identified biomarkers and their involved pathways, which can serve as potential prognostic markers and therapeutic targets to treat kidney impairment due to metabolic syndrome.

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Evaluating the Effectiveness of Human-Like AI Agents in Collaborative Problem-Solving Tasks

Successful teamwork relies on social coordination and synchronised behaviours between team members. As artificial intelligence (AI) becomes increasingly prevalent in training environments, understanding how these agents can effectively collaborate with humans to solve complex problems is crucial. Past research highlights that artificial agents capable of mimicking human decision-making and adapting to their partner's behaviours are better at enhancing human performance.

For the current study, we developed artificial agents using human data from previous experiments to ensure they could emulate human-like behaviours and decisions. Additionally, they were programmed to adapt to participant's movements throughout the task. To evaluate their effectiveness, 88 participants from introductory psychology units at Macquarie University completed a virtual reality shepherding task working alongside these artificial agents, whose behaviours changed over time, to corral sheep to a containment zone. Prior research has revealed that the optimal herding strategy required rhythmic oscillations around the containment zone. Agents were designed to imitate pre-discovering or non-discovering human behaviours, and they could either adapt or not adapt to their human partner's behaviours.

Our findings showed that participants who interacted with the pre-discoverer agent were more likely to discover the oscillatory strategy, and they did so in less time. Those who discovered it also exhibited increased behavioural synchrony with their AI partners. Whilst adaptivity did not affect the likelihood of strategy discovery, it facilitated better strategy adherence once discovered. These results offer valuable insight into the design of AI agents capable of enhancing human-autonomy teaming and training outcomes in diverse settings.

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An Investigation into the Penalised Regression Models: Insights from the LASSO (Least Absolute Shrinkage and Selection Operator) Family

In this study, we explore the efficacy of the LASSO family of penalised regression models, including LASSO, Group LASSO, and Sparse Group LASSO, in addressing the challenges posed by high-dimensional datasets. High-dimensional datasets, characterised by a large number of predictors relative to observations, often undermine the effectiveness of traditional linear regression models, leading to issues such as overfitting and multicollinearity. Motivated by these limitations, we examined the performance of penalised regression approaches in providing more robust and interpretable models under these conditions.

Our findings indicate that LASSO models offer significant improvements in high-dimensional settings by enforcing sparsity, thereby selecting only the most relevant predictors. Furthermore, we observed that, in cases where the data exhibits an inherent grouping structure, Sparse Group LASSO outperforms Group LASSO. While both models account for grouped data, Sparse Group LASSO uniquely enforces both group-level and within-group sparsity, making it better suited for structured, high-dimensional datasets. These insights demonstrate the value of penalised regression models in modern, complex datasets and provide a foundation for further research in sparse modelling techniques.

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Digital Psychological Interventions in Youth with Neurological Conditions: Systematic Review

Background and aims: This study reviewed the efficacy of digitally delivered psychological interventions that are available for youth with neurological disorders with particular focus in improving their psychological, cognitive, and health-related outcomes.

Method/process: Initially studies were found utilising programs such as PsychINFO and MEDLINE. Title and abstract screening were conducted through the Covidence software with 2 authors. After resolving conflicts, full-text screening was conducted using EndNote and an excel spreadsheet. Inclusion criteria required studies to involve randomised controlled trials (RCTs) or single group pre-post designs that incorporated digitally delivered psychological interventions with youth aged less than 18 years who also had a diagnosed neurological disorder.

Results/findings: The review consisted of 16 studies, most of which focused on youth with traumatic brain injury. More than half (9 out of 16) of the studies reported positive effects for behavioural outcomes. However, overall findings reveal mixed efficacy that can be attributed to the studies' lack of methodological rigour.

Conclusion/implications/directions for future research: Future research should seek to continue investigating effective intervention strategies that can be delivered digitally to ensure those with neurological disorders, particularly youth, are able to access these regardless of the restrictions their health-condition may impose. To conclude, determining the effectiveness of digitally delivered psychological interventions will enable this population to access essential and equitable access to psychological care in addition to their neurological care. This is essential, in supporting the health-related quality of life, overall life satisfaction, and psychological outcomes for youth with neurological conditions.

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Decoding Attention Lapses in Dynamic Environments: Insights from EEG and Multivariate Analysis

Sustaining attention in dynamic settings is crucial for effective performance, and attentional lapses can lead to costly errors. This study used electroencephalography (EEG) to investigate neural patterns associated with performance on the Multiple Object Monitoring (MOM) task. Participants tracked multiple moving dots and responded to task-relevant targets to prevent collisions, simulating demands on attention in common real-world tasks. We aimed to replicate previous results where our group successfully predicted attentional lapses during the MOM task from magnetoencephalography (MEG) data - which records substantially cleaner signals than EEG.

Neural data were collected as participants performed the task under either an 'active' (high target frequency) or 'monitoring' (low target frequency) condition. Using multivariate pattern analysis (MVPA), in which patterns of brain activity are used to train machine learning algorithms, we decoded neural activity evoked during 15 distance intervals as dots approached a central obstacle. This allowed us to track neural patterns correlated with dot distance from the central obstacle.

We observed increased neural encoding of task-relevant information as the dot neared the central obstacle, in both conditions. Additionally, in the 'active' condition, we were able to leverage differences in distance information between hits and misses to predict behavioural responses half a second before they occurred. This suggests that attentional failures can be detected before they manifest as behavioural errors. Taken together, these findings show that EEG can reveal early signs of attentional lapses, providing a cost-effective alternative to MEG. This approach holds potential for developing interventions to prevent attention-related errors in high-stakes vigilance environments such as driving or air traffic control.

Keywords: visual attention; vigilance; electroencephalography

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Using Machine Learning to Map Inputs into the Mouse Dorsal Striatum Reveals Functional Involvement in Sleep and Wakefulness

The dorsal striatum is one of four subcortical nuclei comprising the basal ganglia, which together coordinate movement planning and learning. Areas of the brain that project into the dorsal striatum are known to exhibit conserved topographic organisation, where different striatal domains receive distinct combinations of inputs from projection sites throughout the brain. Recent advancements in computational technologies such as artificial intelligence have since facilitated the analysis of large datasets to help understand neuroanatomical connectivity. However, the nature of inputs into the central dorsal striatum remains much lesser known.

Using a supervised machine learning approach and retrograde tract tracing, we identified and quantified neuronal cell bodies that project into a central region in the dorsal striatum of a mouse brain. Here we show novel areas that classically modulate sleep and wakefulness project into the central dorsal striatum. We observed canonical corticostriatal, thalamostriatal, and nigrostriatal pathways, validated known non-canonical projections from the extended amygdala and raphe nuclei, and identified novel inputs from the hypothalamus and brainstem key to the sleep-wake cycle. These findings provide a useful step in consolidating and furthering current knowledge of striatal neuroanatomy and function.

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Enhancing Human-Artificial Agent Coordination: Evaluating the Impact of Training Approaches on Performance and Human Preferences in the Herding Task

Effective collaboration between humans and artificial agents (AAs) in complex tasks requires AAs to balance efficient performance with human-compatible behaviours. This study investigates how different training methods impact human-AA coordination in a collaborative herding task. In Experiment One, we compare the performance and preferences of 72 participants who worked alongside three types of AAs: one utilising a Dynamical Perceptual-Motor Primitives (DPMPs) model and two trained using Deep Reinforcement Learning (DRL) – one trained via self-play and the other trained alongside a DPMP-based AA. Building on these findings, Experiment Two involved 40 new participants to investigate how different training conditions influenced performance and preferences, focusing on two DRL-based AAs.

Results from Experiment One showed that DPMP-based AA consistently outperformed both DRL agents in task completion times and human-compatible behaviours and was preferred by participants due to its simplicity and predictability, despite the superior technical capabilities of DRL-based agents. Interestingly, both experiments demonstrated that training DRL agents alongside DPMP-based AA improved human-compatible behaviours, task performance, and participant preferences compared to self-play training, although these DRL agents still struggled to sufficiently match human-like decision-making patterns. These findings highlight the complexities of designing AAs that balance task efficiency with human-compatible behaviours, emphasizing the need for training methods that enhance real-world human-AA coordination. The study's implications for enhancing human-AA coordination are discussed.

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Eyeing Those Gains: Investigating Visual Mechanisms Behind Muscle Perception

Social media has increased the number of extreme (e.g., thin, muscular) bodies that people are exposed to. Persistent viewing of such extreme bodies can lead to the misperception of body size and shape — a phenomenon associated with disorders such as anorexia nervosa and muscle dysmorphia. While researchers have focused on the perception of adiposity and theories of social comparison, relatively little is known about muscularity perception.

Viewing highly muscular bodies can cause perceptual 'adaptation', making subsequently seen bodies appear less muscular, and vice versa. Such perceptual 'aftereffects' imply the existence of neurons that encode the adapted stimulus feature (muscularity). To understand the functional properties of these neurons, we examined whether muscularity-selective neurons are retinotopic, i.e., respond only to stimuli presented in a small retinal region. Participants were instructed to adjust the muscularity of various 'test' bodies until they appeared 'normal', both before and after visual adaptation. Participants adapted to a series of either high or low muscularity bodies, and subsequent body stimuli appeared in various retinal locations.

Significant differences in the levels of muscularity participants perceived as 'normal' before vs. after visual adaptation imply that aftereffects occurred at all test locations, for both high and low muscularity adaptation. However, the lack of differences in aftereffect sizes between test positions suggests that muscularity-selective neurons are predominantly non-retinotopic, responding similarly to stimuli regardless of retinal location. These findings confirm that the muscularity aftereffect depends on high-level neural mechanisms and cannot be accounted for by long-established aftereffects at lower levels of processing.

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The Valence-Dominance Model Applied to Body Perception: Does Viewpoint Matter?

A widely accepted model of first impressions posits that trait judgments of faces have two underlying dimensions: valence (i.e. trustworthiness) and dominance (Oosterhof and Todorov, 2008). Previous studies have tested whether this valence-dominance model of face perception applies to body perception, with conflicting results. While Morrison et al. (2017) only found one dimension, Tzschaschel et al. (2022) found two: valence and dominance. Given previous findings that stimulus viewpoint can significantly alter trait ratings (Kitamura and Watanabe, 2021), the present study aimed to determine whether this confound can explain the discrepancy between previous studies.

In this online study, participants (N=563) rated the same 100 identities in either front or profile view on 14 traits using a 7-point Likert Scale. A data reduction method – factor analysis – was used to determine the underlying dimensions of trait perception. Both viewpoints produced two factors, replicating the valence-dominance model. Therefore, the stimulus viewpoint did not affect the underlying dimensions of trait perception, suggesting that the discrepancy between past studies is likely due to other stimulus differences. Confirmation that the valence-dominance model applies to body stimuli and face perception raises the possibility that this model may apply to trait perception more generally.

Future research should determine whether valence and dominance arise in other aspects of person perception, such as movement perception (e.g. walking gait) or touch perception (e.g. handshakes). Understanding the factors involved in character judgments has implications for designing interactive AI models to maximise positive first impressions such as trustworthiness.

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Depression and Anxiety Differentially Relate to Olfactory Ability

Social connections between humans are strengthened by repeated exposure to the body odour of friends, family, and partners. Therefore, it should be unsurprising to learn that the loss of our sense of smell predicts feelings of depression. However, the rise of technological advancements has seen the fall of in-person socialising. A limitation of online communication is the inability to connect through evolutionary mechanisms involving smell, known in the literature as 'chemosignalling'. For example, studies suggest that poorer olfactory ability is associated with negative affect.

This study investigated the relationship between depression, anxiety, and olfactory ability. We predicted that higher symptoms of depression and anxiety would be associated with decreased ability to identify and discriminate odours. A sample of 125 Macquarie University students completed self-report surveys on depression and anxiety, and standardised odour identification and discrimination tests.

Results suggested higher depression was associated with reduced olfactory identification, particularly in males, and higher avoidance of social events was associated with increased olfactory discrimination. These findings suggest that symptoms of mood and anxiety disorders may differentially relate to olfactory ability. Reasons for increased odour discrimination in socially avoidant individuals may include hypervigilance as a tool to detect and avoid potential threats.

Further research differentiating between symptoms of clinical disorders, particularly different types of anxiety is warranted. As such, although technological advancements have many positives, olfactory communication may facilitate stronger bonds with repeated in-person exposure to friends and family.

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AI Approaches for Predicting Prognosis and Exacerbations in Patients with Chronic Obstructive Pulmonary Disease (COPD)

Background: Chronic obstructive pulmonary disease (COPD) is a leading cause of mortality and morbidity globally. Artificial intelligence (AI) holds considerable potential to enhance the management and care of COPD patients.

Objective: This narrative review explores the utility of AI in predicting prognosis and exacerbations in COPD.

Methods: A literature search was conducted using PubMed, with key terms "Chronic Obstructive Pulmonary Disease," "Artificial Intelligence," and "Machine Learning." Studies in four aspects, including prognosis, exacerbations, hospitalisations and readmissions, were reviewed.

Results:
PROGNOSIS: A systematic review of 18 studies up to 2023 found that machine learning (ML) models were no better in predicting mortality and exacerbations than COPD severity scores, whereas a retrospective cohort study found that ML models could predict acute respiratory failure, ventilator dependence and mortality.
EXACERBATIONS: Four studies reported the usefulness of ML for predicting first-time exacerbations, identifying factors increasing exacerbation days, predicting the daily risk of exacerbations, and differentiating COPD from heart failure.
HOSPITALISATIONS: Four studies found that ML incorporating previous exacerbation rates, administrative data, and CT chest measurements provided a good prediction of the frequency of hospitalisations.
READMISSIONS: Four studies showed that various ML models had moderate performance across several evaluation metrics when predicting COPD readmission risk using knowledge-driven or data-driven features from routinely collected data.

Conclusions: Current AI predictive models perform moderately well in predicting prognosis, exacerbations, hospitalisations and readmissions in patients with COPD. Future studies should evaluate patient and healthcare provider experience, health outcomes, cost-effectiveness, health equity, and effectiveness in real life settings.