

On-line Programme Wednesday 29th April 2026

09:00 – 12:00 noon BST, 6.00 – 9pm AEST

Link: [Cookson Scholars Conference Zoom link -29 April 2026 \[unimelb.zoom.us\]](https://unimelb.zoom.us/j/91111111111)

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Introduction

9:00-9:05am BST 6.00-6:05pm AEST	Conference Open and Acknowledgement of Country
9:05-9:10am BST 6.05-6:10pm AEST	Dr Mike Taylor – University of Manchester Welcome Address
9:10-9:15am BST 6.10-6:15pm AEST	Prof Elizabeth Cartwright - University of Melbourne Overview of Cookson Scholars Joint Program and look at First five years of collaboration

Session 1

9:15-10:30am BST 6.15-7.30pm AEST	Chair: Judges:	Amanda Aspinall Rebecca Whitsed – University of Melbourne Brooke Farrugia – University of Melbourne
9:15– 9:30am BST 6.15-6:30pm AEST	Ellen Gray	Investigating the Role of Systemic Inflammation in the Development of Post-Stroke Cognitive Impairment
9:30 – 9:45pm BST 6.30-6.45pm AEST	Mariia Bobyleva	What Is an Urban Digital Twin? From Conflicting Definitions to Configurable Infrastructures
9:45 –10:00am BST 6.45-7.00pm AEST	Samuel Ashman	Investigating the inflammatory mechanisms underlying the onset of emotional and cognitive disorders following repeated mild traumatic brain injury (mTBI) in mice.
10:00 -10:15am BST 7.00-7:15pm AEST	Akshay Kashyap	Spending smarter on fluoride removal
10:15-10.30am BST 7.15-7.30pm AEST	Hanqing (Heidi) Wang	Ocular immune status in mice following ischemic stroke
10:30-10:45am BST 7.30- 7.45pm AEST		BREAK

Session 2

10:45-12:00am BST 7.45-9.00pm AEST	Chair Judges:	Helen Barber Adrien Querbes – University of Manchester Laura Richards – University of Manchester
10:45 -11:00am BST 7.45-8.00pm AEST	Dilshan Delgama	Co-designing digital support for parents of young children with cochlear implants: insights from focus groups
11:00-11:15am BST 8.00-8.15pm AEST	Jessica Hall	Neuroinflammation in Traumatic Brain Injury: The role of IRF7
11:15-11.30am BST 8.15-8.30pm AEST	Jianbo Xu	When Geometry joins the Action: Revisiting the coffee ring effect in bioinspired photonic cellulose
11:30-11:45am BST 8.30-8.45pm AEST	Prof Dani Tomlin	Close of conference

Session 1

Ellen Gray – University of Manchester - Investigating the Role of Systemic Inflammation in the Development of Post-Stroke Cognitive Impairment

Post stroke cognitive impairment (PSCI), impairs independence and functional recovery. Ageing is associated with increased risk of PSCI; however, this risk factor is seldom incorporated into preclinical models of stroke. Increasing evidence suggests the release of inflammatory mediators and immune cells in stroke can promote cognitive deficits, yet deciphering the complex relationship between systemic inflammation and central neurodegeneration is essential.

We aimed to correlate changes within the brain and peripheral tissues with the development of cognitive impairment, to investigate potential therapeutic targets and novel biomarkers for stroke.

Following distal middle cerebral artery occlusion (dMCAO), 14-month C57BL6 mice underwent a battery of behavioural tests and MR imaging at baseline, 8-, and 16-weeks. Once culled, investigation into the inflammatory status of the blood, brain, and eye was performed through flow cytometry and immunofluorescent analysis.

Cognitive decline was observed in stroke groups during the Novel Object Recognition ($p < 0.05$), Y-Maze ($p < 0.05$), and Barnes maze ($p < 0.05$) tasks. Deficits in learning and memory during a touchscreen task were evident within the stroke group ($p < 0.05$).

Stroke caused a significant increase in tissue damage when compared to sham controls ($10.59 \pm 0.835 \text{ mm}^3$; $p < 0.0001$). Flow cytometry revealed no significant difference in the blood, bone marrow, and lung at 9 months post stroke, however, work is ongoing to investigate morphological and inflammatory changes within multiple peripheral organs.

Changes within cognitive domains were reported at 8-weeks and further declined at 16-weeks. Furthermore, investigation into the pathophysiological correlates of cognitive

decline is ongoing which may prove beneficial in the diagnosis, prognosis, and prevention of the disease.

Mariia Bobyleva - University of Manchester - What Is an Urban Digital Twin? From Conflicting Definitions to Configurable Infrastructures

Urban Digital Twins (UDTs) are increasingly promoted as infrastructures for urban planning, coordination, and sustainability action. Yet the term is applied to materially different systems, from static 3D city models to near-real-time operational environments, generating conceptual ambiguity that limits comparison, governance design, and value assessment. This presentation reports completed analytical work that clarifies what constitutes “twin-ness” in urban contexts.

Based on a structured synthesis of UDT definitions, city-scale architectures, and governance frameworks published between 2018 and 2025, six recurring dimensions were identified that consistently differentiate UDT configurations: coupling direction, temporal coupling, agency, integration scope, interoperability and semantic alignment, and purpose orientation. Results show that coupling claims form the most stable definitional anchor, yet strong technical ideals—bidirectional, real-time, high-agency systems—are rarely realised in reported city implementations. Most initiatives labelled as UDTs operate as partially coupled “digital shadows” providing decision support rather than cyber–physical control.

The analysis further demonstrates that this divergence reflects governance and value constraints, including accountability allocation, legitimacy requirements, cybersecurity exposure, procurement dynamics, and organisational capability, rather than purely technological limitations.

The presentation introduces a graded configuration framework that translates heterogeneous terminology into comparable UDT types. This enables transparent classification of urban digital twins and supports comparative reasoning about how specific configurations align with governance arrangements and business-model logics, shifting the debate from definitional purity to feasible and valuable urban digital twin designs.

Samuel Ashman – University of Manchester - Investigating the inflammatory mechanisms underlying the onset of emotional and cognitive disorders following repeated mild traumatic brain injury (mTBI) in mice.

Mild traumatic brain injuries (mTBI) are a significant risk factor for the development of long-term emotional disorders and cognitive dysfunction, as well as neurodegenerative conditions including chronic traumatic encephalopathy. This study investigated the immune response to four repeated mTBIs at 60 days post injury (n = 6; sham: n = 6) in mice, using a closed head injury model of mTBI. The study additionally assessed working and spacial memory at 60 days, following previous work characterising several behavioural deficits that occur up to 120 days post injury. Spatial and working memory

was assessed from Barnes maze exploratory behaviours, and the neuroimmune response to injury was characterised using flow cytometry analysis. In the meninges, several immune cell populations, including monocytes ($p=0.0465$) and B cells ($p=0.0337$) decreased following repeated mTBI, whilst macrophages showed increases in the expression of pro-inflammatory surface receptors (PD-1: $p=0.0401$; MHCII: $p=0.0483$).

Within the brain, microglia showed no changes in phenotype post repeated mTBI, but increased numbers of T cells ($p=0.0134$), and changes in the specific subsets. This study indicates that the onset of an anxiety-like behavioural phenotype occurs at following several changes in the immune landscape of the brain and meninges. These changes may drive the increased severity of cognitive symptoms following repeated mTBIs. Ongoing work within this model may allow us to identify the potential mechanisms in which the T cell response following repeated mTBI may be driving the onset of emotional and cognitive disorders.

Akshay Kashyap – University of Melbourne - Spending smarter on fluoride removal

Community-scale defluoridation systems have been widely implemented in fluoride-affected, groundwater-dependent regions to reduce risks from excessive geogenic fluoride in drinking water. Performance is typically judged by whether treated water meets a guideline threshold (e.g., 1.5 mg/L fluoride, World Health Organization). In practice, however, meeting a threshold requires a site-specific metric: the fluoride removal efficiency needed to reach the target from the local source-water concentration. Because this requirement varies across sites (and potentially seasons), treatment should be benchmarked against required removal rather than applied uniformly. Here, we quantify site-specific required removal targets and compare them with achieved removal using paired pre- and post-treatment measurements. We apply this framework to 58 community water purification plants (CWPPs) in Bankura and Purulia districts of West Bengal, India, to quantify required versus achieved removal and identify where operational intensity (e.g., media choice, run time, regeneration frequency) should differ. Pre-filter fluoride ranged from 1.6 to 8.2 mg/L. To meet the WHO guideline of 1.5 mg/L, required removal efficiencies were 11.8 - 81.7% in Bankura (median 54.5%) and 6.3 - 61.5% in Purulia (median 28.6%), with an overall median requirement of 33.3% across both districts. Even for a stricter target of 1.0 mg/L, median required removal largely remained below 70%. These results show that many community systems do not need near-complete fluoride removal but require clearly defined, site-specific targets spanning moderate to very high removal. This difference matters for operations: a plant that needs ~30% fluoride removal shouldn't use the same media, run time, or regeneration schedule as one that needs ~80% removal.

Heidi Wang – University of Melbourne Ocular immune status in mice following ischemic stroke

Propose: To investigate ocular inflammatory cell changes in a mouse model of ischemic stroke.

Methods: Twelve C57BL/6 mice, aged 8 to 12 weeks, underwent permanent middle cerebral artery occlusion (pMCAO) surgery by inserting a monofilament suture. A control group ($n = 14$) receiving sham surgery was included. Corneal tissues were collected 24 hours after surgery. Whole-mount immunofluorescence staining was performed to evaluate corneal immune cells and sensory nerves.

Results: At 24 h after ischemic stroke, sub-basal nerve plexus nerve density in the peripheral cornea was lower in the stroke group than the sham surgery group (ipsilateral: $3.54\% \pm 1.54\%$ vs $6.43\% \pm 1.76\%$; $p < 0.01$; contralateral: $3.72\% \pm 0.93\%$ vs $6.76\% \pm 1.87\%$; $p < 0.0001$), as well as in the central cornea (ipsilateral: $2.59\% \pm 1.12\%$ vs $6.33\% \pm 2.07\%$; $p < 0.0001$; contralateral: $2.91\% \pm 1.05\%$ vs $6.26\% \pm 2.05\%$; $p < 0.001$). The density of corneal intraepithelial dendritic cells in the peripheral cornea was lower compared to the sham group (ipsilateral: 17.42 ± 9.97 cells/mm² vs 26.72 ± 11.19 cells/mm²; $p < 0.05$; contralateral: 17.28 ± 6.44 cells/mm² vs 24.18 ± 5.18 cells/mm²; $p < 0.01$). Cell perimeter and field area of dendritic cells in the contralateral peripheral cornea, were lower in the stroke group. No difference in the macrophage and neutrophil cell density was observed.

Conclusions: Ischemic stroke may cause ocular changes including alterations in corneal sensory nerve density and corneal immune cell density and morphology

Session Two

Dilshan Delgama - University of Melbourne Co-designing digital support for parents of young children with cochlear implants: insights from focus groups

Authors

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Background & Aim

Parents and caregivers of young cochlear implant recipients often face complex informational, emotional and practical challenges. Digital tools may offer support, but limited research has explored how such tools should be designed to align with their needs. Co-design approaches can help integrate end-user priorities into digital health development. This study explored parent and caregiver perspectives on a low-fidelity digital prototype designed to support families early in their child's cochlear implant journey, defined as the period after the decision to implant through 3-6 months post-operation.

Methods

Three semi-structured focus groups were conducted with parents and caregivers of

children who received their cochlear implant before the age of three in Australia or New Zealand. Discussions were guided by a structured interview schedule exploring perceived usefulness, usability, and acceptability of the prototype. Focus groups were recorded, transcribed, and analysed using inductive content analysis.

Results

Fourteen parents and caregivers participated across three focus groups. Participants described seeking support at key milestones and during periods of uncertainty, highlighting the importance of timely, accessible, and actionable information. The prototype was perceived as useful for administrative guidance and supplementary information not routinely provided in clinical consultations. Peer support was highly valued for experiential knowledge and emotional reassurance. Participants emphasised inclusive design, community authenticity, and the importance of professional endorsement to establish trust.

Conclusion

Findings provide user-informed insights to guide refinement of a digital support tool for families early in the cochlear implant journey. Future research should evaluate usability, acceptability and integration within clinical pathways.

Jessica Hall – University of Melbourne - Neuroinflammation in Traumatic Brain Injury: The role of IRF7

Traumatic brain injury (TBI) is a major cause of death and permanent disability worldwide. Prolonged inflammation from TBI can lead to chronic cognitive defects and contribute to onset of neurodegeneration, though the exact mechanisms throughout the brain remain poorly understood. Previous studies show that targeting type-I interferon signalling confers a protective effect after TBI in the short term. Therefore, I investigated the influence of Interferon Regulatory Factor 7 (IRF7), a key mediator of type-I interferon signalling, on microglial activation and neuronal health following TBI. Our lab performs a moderate controlled cortical impact on wildtype or IRF7 $-/-$ mice over the right cortex. Earlier studies demonstrate recovered microglial morphology after TBI 6 months post-TBI, along with decreased inflammatory cytokines at 7 days post-TBI. At 6 months post TBI, IRF7 $-/-$ mice displayed less anxiety-like behaviour and enhanced recognition memory abilities. My research expands on these findings with mass spectrometry proteomics analysis on wildtype and IRF7 $-/-$ mouse brains at baseline and 24 hours post TBI. I demonstrate that IRF7 knockout not only influences the expression hundreds of proteins after injury, but also at baseline before injury. Many proteins also exhibit a sex-specific change upon IRF7 knockout. Together, these data highlight the intriguing role of IRF7 in both health and disease and open a potential avenue for better understanding and treatment of neuroinflammation.

Jianbo Xu - When Geometry joins the Action: Revisiting the coffee ring effect in bioinspired photonic cellulose

Cellulose nanocrystals (CNCs) are plant based sustainable rod-like colloidal particles that can spontaneously self-assemble into helicoidal (cholesteric) structures during evaporation of aqueous suspensions. Upon complete drying, this helicoidal organisation gives rise to iridescent structural colours similar to those found in scarab beetles. Typically formed via sessile droplet drying, internal fluid dynamics during evaporation strongly influences the particle deposition in particular around the edge of the droplet. These circular patterns known as the coffee ring effect (CRE). While the CRE has been extensively studied in circular droplets, the role of droplet geometry, particularly introduction of angular features remains poorly understood. Here, we demonstrate that geometrical confinement plays a significant role in governing CRE, modulates internal flow fields, consequently the self-assembly and photonic features of the CNC films. By systematically scaling the droplet size and template geometry, we show that local geometry modulates the balance between capillary and Marangoni flows, altering the CNC transport and deposition profiles.

This shape-flow coupling provides a previously unreported design strategy to suppress CRE and control surface uniformity without the use of additives or post-treatments. By harnessing geometry as an active design parameter, this work establishes a new bioinspired framework for manufacturing cellulose based photonic coatings and security features. We have ongoing investigations into colour development in scarab beetles also suggests that similar cholesteric phases emerge within confined biological geometries during cuticle formation, supporting the relevance of geometric control in bioinspired photonic design.