Cookson Scholars Conference 2025

Program

Date:	Wednesday, 2 April 2025 and Thursday, 3 April 2025	**Time:**	8:00-11:00am BST/ 6:00-9:00pm AEDT
Venue:	Via Zoom		
Link:	https://unimelb.zoom.us/j/82764615699?pwd=PLV8h8PwaVlCH2Wbj8CXDqb2pD2vHJ.1&from=addon		
Enquiries:	jointphd-admin@unimelb.edu.au		

8:00–8:15am BST/ 6:00-6:15pm AEDT	**Conference Open and Acknowledgement of Country**
8:00– 8:05am BST 6:00- 6:05pm AEDT	**Dr Michael Taylor** – University of Manchester Welcome address
8:05 – 8:15pm BST 6:05-6:15pm AEDT	**Prof Alastair Sloan** – University of Melbourne Overview of Cookson Scholars Joint PhD Program

8:15-9:15am BST/ 6:15-7:15pm AEDT	**Session 1 Chair: Akshay Kashyak**
8:15 – 8:30am BST 6:15- 6:30pm AEDT	**Luise Pallasdies** – Cookson Scholar Uncovering new biochemical pathways for marine organosulfur metabolism
8:30 – 8:45am BST 6:30- 6:45pm AEDT	**Ajmal Roshan** – Cookson Scholar A tale of two states: groundwater arsenic contamination in Bihar, India and Victoria, Australia
8:45 – 9:00am BST 6:45- 7:00pm AEDT	**Lucy McElhone** – Cookson Scholar Optimising the electrochemical performance of manganese (II, III) oxide for lithium-ion battery anodes
9:00 - 9:15am BST 7:00- 7:15pm AEDT	**Gwynneth Thomas** – Cookson Scholar Interrogating the history of Australian postcolonial literary studies through the University of Melbourne Handbook

9:15-9:30am BST/ 7:15–7:30pm AEDT	**Break**

9:30–10:30am BST/ 7:30-8:30pm AEDT	**Session 2 Chair: Yuhan Wong**
9:30- 9:45am BST 7:30-7:45pm AEDT	**Dilshan Delgama** – Cookson Scholar Digital tool preferences of parents and caregivers of young children with cochlear implants: survey findings

9:45- 10:00am BST 7:45-8:00pm AEDT	**Meaghan Storey** – Cookson Scholar "Jump[ing] in the deep end": young people's experiences of seeking gender care as minors in Australia
10:00- 19:15am BST 8:00-8:15pm AEDT	**Samuel Ashman** – Cookson Scholar Investigating the inflammatory mechanisms underlying the onset of emotional and cognitive disorders following repeated mild traumatic brain injury (mTBI) in mice
10:15- 10:30am BST 8:15-8:30pm AEDT	**Ellen Gray** – Cookson Scholar Investigating the role of systemic inflammation in the development of post-stroke cognitive impairment

10:30- 10:45am BST/ 8:30-8:45pm AEDT	**Close of Day 1**
10:30- 10:45am BST 8:30-8:45pm AEDT	**Prof Amanda Ellis** – University of Melbourne Concluding remarks

8:00–8:15am BST/ 6:00-6:15pm AEDT	**Day 2 Conference Open and Acknowledgement of Country**
8:00 – 8:05am BST 6:00-6:05pm AEDT	**Dr Michael Taylor** – University of Manchester Welcome address
8:05 – 8:15am BST 6:05-6:15pm AEDT	**Prof Elizabeth Cartwright** – Chair of the University of Manchester Doctoral College Introduction to Day 2

8:15-9:15am BST/ 6:15-7:15pm AEDT	**Session 3 Chair: Lucy McElhone**
8:15 – 8:30am BST 6:15-6:30pm AEDT	**Ronald Leon** – Cookson Scholar Scaling triboelectric nanogenerators for efficient energy harvesting
8:30 – 8:45am BST 6:30-6:45pm AEDT	**Helen Barber** – Cookson Scholar Biochemical characterisation of a novel pathway for homotaurine metabolism in Burkholderia
8:45 – 9:00am BST 6:45-7:00pm AEDT	**Sgianach Hindhaugh** – Cookson Scholar Publishing the postcolonial: academic journals as archive and text in literary studies
9:00 – 9:15am BST	**Mia Wansbrough** – Cookson Scholar The hidden structure of colour: a new perspective on the Australian fiddler beetle

9:15-9:30am BST/ 7:15–7:30pm AEDT	**Break**

9:30–10:45am BST/ 7:30-8:45pm AEDT	**Session 4** **Chair: Kate Gomersall**
9:30 – 9:45am BST 7:30-7:45pm AEDT	**Ellie Rees** – Cookson Scholar Multiplex spatial immunophenotyping to identify predictive biomarkers for relapse in stage IIa primary melanoma
9:45- 10:00am BST 7:45-8:00pm AEDT	**Paulo Della Moglie** – Cookson Scholar Wind assist, weather routing, and BVs: a new, green, optimized sailing practice for the modern shipping sector
10:00- 10:15am BST 8:00-8:15pm AEDT	**Larry Ger Aragon** – Cookson Scholar A global study of marine cloud particle size distributions: bridging aircraft data and climate model assumptions
10:15- 10:30am BST 8:15-8:30pm AEDT	**Margherita Battistotti** – Cookson Scholar Automatic algorithm configuration under streaming problem instances
10:30- 10:45am BST 8:30-8:45pm AEDT	**Akshay Kashyap** – Cookson Scholar Water, water everywhere, nor any drop to drink: the struggle for safe drinking water in India

10:45 – 11:00am BST/ 8:45-9:00pm AEDT	**Close of Day 2**
10:45- 10:00am BST 8:45-9:00pm AEDT	**Dr Michael Taylor** – University of Manchester Concluding remarks and future developments

Titles and Abstract

Session 1

Uncovering new biochemical pathways for marine organosulfur metabolism

Luise Pallasdies

Supervisors: Prof Spencer Williams and Dr Yi Jin

The biogeochemical sulfur cycle encompasses the chemical and biological transformations of sulfur across Earth's biotic and abiotic compartments. Understanding this cycle is crucial due to sulfur's role in life, particularly as a component of the essential amino acids cysteine and methionine. Among the thousands of organosulfur compounds in the biosphere, a few dominate global pools. One such metabolite, D-cysteinolic acid, is widespread in marine bacteria, algae, and diatoms, accumulating in the food chain. However, little is known about its biosynthesis and degradation. This work investigates D-cysteinolic acid catabolism. To achieve this, we have adopted a multidisciplinary approach, combining synthetic chemistry, biochemistry, comparative proteomics and molecular biology. We report the first identification of a Ruegeria pomeroyi DSS-3 racemase that converts D-cysteinolic acid to L-cysteinolic acid, followed by oxidation to L-cysteate via an L-cysteinolic acid dehydrogenase. L-cysteate is then racemized to D-cysteate and undergoes carbon-sulfur bond cleavage by the sulfo-lyase CuyA. To characterize this pathway, we expressed the key enzymes and chemically synthesized intermediates for activity assays and end-product analysis.

A tale of two states: groundwater arsenic contamination in Bihar, India and Victoria, Australia

Ajmal Roshan

Supervisors: Dr Laura Richards and Prof Meenakshi Arora

Elevated concentration of arsenic (As) in groundwater is a major public health concern in several parts of the world. However, their effect on the water security of a region depends on a range of factors that cuts across disciplines. Naturally occurring, high As concentration groundwater is observed in parts of the Indian state of Bihar and government has installed various remediation units to provide safe drinking water to the communities. This study aimed at comparing the distribution of these remediation units with the contaminant distribution and revealed inconsistencies between the two. Government installed As remediation units were found to be disproportionately closer to River Ganges (60 % of the total within 10 km from the river). Regions were identified where much needed remediation interventions were required but presently un(der)-served. Samples collected from 103 locations showed that the installed remediation systems in the state varied in their source-water chemistry, type, technology used, ownership and implementation setting. Results also showed that the As removal by these systems varied from 0-95 %, and that ~85 % of the sampled systems were located in regions where the inlet As concentration was below permissible limit of 10 µg/L. Prior studies have shown that soil samples from parts of the Australian state of Victoria have As concentration higher than natural background values. However, studies focussed on its presence in groundwater are rare, possibly because of its reduced dependency to meet drinking water needs in the state. Future studies will investigate parallels between the two study areas.

Optimising the electrochemical performance of manganese (II, III) oxide for lithium-ion battery anodes

Lucy McElhone

Supervisors: Prof Aravind Vijayaraghavan and Prof Amanda Ellis

The lithium-ion battery (LIB) has revolutionised modern life. LIBs are used for energy storage in devices ranging from portable electronics, such as smart phones and laptops, to electric grids and electric vehicles. However, commercial LIBs have slow charge/discharge rates and limited life cycles, hindering the commercialisation of electric vehicles. This has caused researchers to strive to find alternative materials for energy storage. Mn_3O_4 has a high theoretical capacity, however, pure Mn_3O_4 electrodes suffer from poor conductivity and slow ion diffusion rates. In this work, Mn_3O_4 nanoparticles are combined with reduced graphene oxide (rGO) to make anodes. The synthesised Mn_3O_4/rGO hybrid anode has a higher discharge capacity (531 mAh/g) compared to Mn_3O_4 (332 mAh/g) after cycling at a high current density of 1 A/g. These hybrid anodes can maximise the benefits of each component and achieve synergy between the two, presenting an opportunity to combat the challenges driven by the rising global energy demand.

Interrogating the history of Australian postcolonial literary studies through the University of Melbourne Handbook

Gwynneth Thomas

Supervisors: Dr Lynda Ng and Dr Anastasia Valassopoulos

There are three articles of faith amongst Australian postcolonial literary scholars today: first, the 'dual origins' theory that postcolonial literary studies emerged in the 1970s from an amalgamation of Commonwealth Literary Studies and colonial discourse analysis. Second, that the field's formative moment was the publication of Ashcroft et al.'s seminal The Empire Writes Back in 1989. Third, that the advent of the postcolonial paradigm initiated a break from earlier modes of textual analysis and profoundly changed Australian literary studies. Despite this, there is a lack of detailed scholarship on the development of postcolonial literary studies at specific universities in Australia. In this paper, I use the records of the annual University of Melbourne Handbook to interrogate this received history of the field and trace the origins, development, and current forms of postcolonial literary studies at this institution. Through analysing the titles, descriptions, and prescribed text lists for the subjects offered by the English department from 1970 to 2025, I demonstrate that the evolution of postcolonial literary studies' scope, theory and methods can be read from the teaching record. I suggest that, at this university, the impact of postcolonialism on Australian literary studies has been both less contentious and less enduring than previously believed.

Session 2

Digital tool preferences of parents and caregivers of young children with cochlear implants: survey findings

Dilshan Delgama

Supervisors: A/Prof Karyn Galvin and Dr Karolina Kluk

Objectives: This study aims to explore the parent and caregiver preferences for a digital intervention to support families throughout the cochlear implantation process. Methods: An anonymous, online survey was conducted with parents and caregivers of children who received a cochlear implant before the age of three in Australia or New Zealand. The survey includes 28 questions exploring parents' and caregivers' preferences for a digital

tool, primarily in Likert scale format. Results: A total of 66 parents and caregivers responded to the survey, with 48 meeting the eligibility criteria. Preliminary findings suggest that parents and caregivers would find a digital tool very useful if it included information on the medical aspects of hearing loss, available services, and cochlear implant maintenance. Many also expressed that the ability to access personal stories from other families and connect with other parents and caregivers would be valuable. Most respondents emphasised the importance of both information and peer support within the digital tool. They also indicated that the tool would be most useful equally both before implantation and in the first six months after the child received a cochlear implant. Key features identified as important included a FAQ section, a service directory, verified information sources, and peer communication options. Conclusion: These preliminary findings highlight the importance of accessible, evidence-based resources and peer connections. A digital tool has the potential to address these needs by providing tailored information and fostering community support.

Jump[ing] in the deep end": young people's experiences of seeking gender care as minors in Australia

Meaghan Storey

Supervisors: Prof Simona Giordano and Prof Lynn Gillam

Background: Young people who are seeking access to gender care are faced with long wait times and must navigate various healthcare pathways.Within a wider context of heightened scrutiny of paediatric and adolescent gender care, such information is increasingly hard to find and navigate. This article explores young people's experiences of seeking gender care as a minor in Australia. Methods: This article reports on findings from qualitative interviews with 14 participants from across Australia who accessed gender services as minors. This critical phenomenological study forms part of a larger empirical ethics project. Data was analysed using reflexive thematic analysis. Results: Four overarching themes have been identified from the data: 1) information gathering, 2) context awareness, 3) expectations and preparation, and 4) a lack of clinical transparency. Participants identify how they navigated challenges and provide recommendations to support young people during this early stage of seeking care. Conclusion: Despite participants' efforts to seek out information and understand clinical processes, many participants experienced a gap in information and transparency around the process of accessing gender services. Ethically, improving service transparency respects young people's developing agency and may facilitate better service engagement.

Investigating the inflammatory mechanisms underlying the onset of emotional and cognitive disorders following repeated mild traumatic brain injury (mTBI) in mice

Samuel Ashman

Supervisors: Prof Michael Harte and Prof Peter Crack

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 behavioural changes and immune response to four repeated mTBIs (n = 20; sham: n = 20) in mice, using a closed head injury model of mTBI. Anxiety-like exploratory behaviour within the elevated plus maze was unaffected by repeated mTBI at 5 days post injury (p=0.6795; Mann-Whitney U Test) but was found to have significant effects at both 45 (p=0.0009; Mann-Whitney U Test) and 90 (p=0.0052; Mann-Whitney U Test) days post injury. Locomotor activity was unaffected by treatment at all timepoints. Performance in the novel object recognition task was unaffected in the repeated mTBI group at all three timepoints, however the repeated mTBI group showed significant decreases in total object exploration

times at 90 days post injury (p=0.0008; Unpaired t-test). Spatial and working memory was assessed from Barnes maze exploratory behaviours, and the neuroimmune landscape was characterised using flow cytometry analysis. This study indicates that the onset of an anxiety-like behavioural phenotype occurs at chronic timepoints following repeated mTBIs in our rodent model, replicating common symptoms seen within humans following repeated mTBI. These changes may result from a chronic inflammatory response following repeated mTBIs. Ongoing work within this model may allow us to identify any potential inflammatory mediators driving the secondary injury phase of repeated mTBI underlying the onset of emotional and cognitive disorders.

Investigating the role of systemic inflammation in the development of post-stroke cognitive impairment

Ellen Gray

Supervisors: Prof Stuart Allen and Prof Laura Downie

Ageing is associated with increased risk of cognitive decline following stroke; however, this risk factor is seldom incorporated into preclinical mouse models of stroke. Increasing evidence suggests the release of inflammatory mediators and immune cells in stroke can promote cognitive deficits, however, deciphering the complex relationship between systemic inflammation and central neurodegeneration is essential. We aim to correlate changes within the brain, blood, and eye with the development of cognitive impairment, to investigate potential therapeutic targets and novel biomarkers for stroke. Following distal middle cerebral artery occlusion (dMCAO) stroke or sham surgeries, 14-month C57BL6 mice underwent a battery of behavioural tests to investigate cognitive changes and MR imaging at baseline, 8-, and 16-weeks post stroke; and a touchscreen-based behavioural paradigm at 20 weeks. Once culled, investigation into the inflammatory status of the blood, brain, and eye was performed through flow cytometry and immunofluorescent analysis. As expected, stroke caused a significant increase in tissue damage when compared to sham controls. An impairment in recognition memory was observed in stroke groups during the novel object recognition task at both timepoints when compared to sham groups ($p<0.05$) and baseline ($p<0.001$). Furthermore, spatial memory deficits were highlighted in stroke groups during the Y-Maze task ($p<0.05$), and impairments in cognitive flexibility were observed during Barnes Maze at the 8-week timepoint ($p<0.05$). Deficits in learning and memory during the pairwise discrimination touchscreen task were evident within the stroke group ($p<0.05$). Changes within several cognitive domains were reported at 8-weeks and further declined at 16-weeks post stroke. Furthermore, investigation into the pathophysiological correlates of cognitive decline are currently ongoing which may prove beneficial in the diagnosis, prognosis, and prevention of the disease.

Session 3

Scaling triboelectric nanogenerators for efficient energy harvesting

Ronald Leon

Supervisors: Prof Amanda Ellis and Prof Aravind Vijayaraghavan

Energy harvesting from daily activities has enabled the development of nanogenerators, which convert ambient energy into electricity. Triboelectric nanogenerators (TENGs) generate electricity by transferring charge during mechanical stimulation between two distinct materials. While recent research has focused on improving energy conversion efficiency, most TENGs still fail to provide sufficient power to drive energy conversion processes, leading to significant energy losses and limited real-world applications. This study introduces simple scaling

strategies to enhance TENG outputs by analysing two popular scaling strategies. These methods increase surface area while maintaining flexibility and simplicity. Specifically, a single unit based axial scaling approach is highlighted as an effective fabrication method, compared to the often-used folded vertical stacking approach. Unlike conventional TENGs, which rely on inefficient bi-material contact separation, volumetric TENGs are said to generate triboelectric signals across multiple friction layers. However, results from this study indicate that increasing the number of friction layers only incrementally improves the electrical output (<0.05 μW/cm2), while the unit scaling approach exhibited an output power density an order of a magnitude higher (~0.7 μW/cm2). Additionally, it was also found that the triboelectric pair for volumetric TENGs needs to be optimised for scalability, which can improve the consistency of the time domain signals by over 20% (standard deviation of the current intensity). Therefore, this study proposes the use of the novel unit-scaling approach for cost-effectiveness and also 5x higher efficiency of scalable TENGs.

Biochemical characterisation of a novel pathway for homotaurine metabolism in Burkholderia

Helen Barber

Supervisors: Dr Yi Jin and Prof Spencer Williams

One of the four essential macronutrients, sulfur is required in some capacity by all life, moving through the environment in the biogeochemical sulfur cycle. Understanding this cycle is essential to understanding the role sulfur plays in life. Homotaurine is an organosulfonate compound biosynthesized by marine algae and found in high concentrations in seawater. Whilst numerous studies have been completed on the metabolism of its structural homologue, taurine, less is known about homotaurine. Despite their structural similarities, many enzymes that utilise taurine as a substrate cannot efficiently metabolise homotaurine. Recently, the bacterium Burkholderia sp. CT39-3 was observed to grow on homotaurine as a sole carbon source, with proteomic analysis revealing a novel pathway for homotaurine metabolism distinct from taurine metabolism, and containing enzymes homologous to the Krebs cycle, a major biochemical pathway. Homotaurine is imported into the cell by an ABC-type transporter, HtaABC, before conversion to sulfopropanal via an aminotransferase, HtaE, and then to sulfopropanoate via an aldehyde dehydrogenase, HtaF. Sulfopropanoate is a structural homologue to succinate, a Krebs cycle metabolic intermediate. SpuABCD and SpuIJ, homologous to succinic dehydrogenase and fumerase respectively, produce R-sulfolactate from sulfopropanoate. The carbon-sulfur bond is then cleaved by SuyAB yielding pyruvate and sulfite. Biochemical characterisation was completed using isothermal titration calorimetry, kinetic studies, and structural analysis using a combination of X-ray crystallography and Alphafold 3 modelling, confirming the pathway's specificity for homotaurine. Bioinformatics analysis was further completed to explore the distribution of homotaurine metabolism throughout bacterial species.

Publishing the postcolonial: academic journals as archive and text in literary studies

Sgianach Hindhaugh

Supervisors: Dr Anastasia Valassopoulos and Dr Lynda Ng

Academic journals serve as both archives and active agents in shaping literary discourse. My research examines The Journal of Postcolonial Writing (JPW) and The Australian Journal of Postcolonial Studies as primary sources, demonstrating how keyword analysis, editorial trends, and thematic mapping reveal broader shifts within postcolonial studies. By applying these methods, I trace how both journals reflect evolving disciplinary concerns, with a particular focus on JPW's increasing engagement with Europe as a site of

postcolonial inquiry. A keyword analysis of JPW titles from 1970 to 2024 shows a marked shift: prior to 2000, only four articles included the term ‘Europe,’ whereas from 2000 onwards, 34 articles did. Similarly, references to ‘British’ or ‘Britain’ increased from a single instance between 1970 and 2000 to 28 occurrences post-2000. Special issues further highlight this reorientation—between 2012 and 2022, JPW published seven special issues explicitly focused on Europe, accounting for 24.1% of all special issues in that decade. These findings indicate a significant transformation in postcolonial studies, reflecting a growing tendency to interrogate colonial legacies within Europe itself. While this methodological approach is applied to both JPW and The Australian Journal of Postcolonial Studies, this presentation focuses on JPW as a case study, demonstrating how analysing academic journals as both archive and text can uncover disciplinary trends and reframe postcolonial literary scholarship.

The hidden structure of colour: a new perspective on the Australian fiddler beetle

Mia Wansbrough

Supervisors: Prof Devi Stuart-Fox and Dr Ahu Gumrah-Parry

Colouration in nature has fascinated humans for thousands of years due to its vivid and eye-catching properties. In many species, these striking colours result from sub-micrometre structures that interfere with visible light, a phenomenon known as structural colouration. Traditionally, it has been assumed that structural colour does not fade after death, as the underlying structures remain intact, and thus colouration that does fade must be the result of pigmentary colour. A striking example is the Australian fiddler beetle, Eupoecila australasiae, which displays bright green or yellow stripes against a dark cuticle. However, these colours fade to a dull brown after death, leading to the long-standing assumption that they are pigmentary. Extensive SEM and TEM imaging of the beetle's cuticle has revealed the presence of 2.5D photonic structures within the coloured regions. Further optical characterisation through hyperspectral imaging has confirmed that these structures are responsible for the beetle’s vibrant colouration. This discovery challenges our understanding of colour in the natural world. Further research into the development of these structures could inspire the creation of photonic materials that manipulate light in similar ways, fostering new collaborations and advancements during my time in Manchester.

Session 4

Multiplex spatial immunophenotyping to identify predictive biomarkers for relapse in stage IIa primary melanoma

Ellie Rees

Supervisors: Prof Caroline Dive and Prof Sarah Jane Dawson

Melanoma is an aggressive cancer of melanocytes responsible for up to 50% of skin cancer deaths worldwide. Approximately 30% of primary melanomas are diagnosed at Stage IIA disease, accounting for a high proportion of patients. Current standard of care for these patients is surgical resection with curative intent, and whilst most Stage IIA patients experience long-term survival, 36-38% of patients relapse within 10-years. Biomarkers are needed which can identify patients at high risk of relapse. Different immune cell types surrounding the tumour can influence the cancer prognosis. CD8+ T-cells have been associated with a good prognosis in melanoma at Stage I/II. Other cells within the tumour microenvironment (TME) including fibroblasts and myeloid cells play an

important role in regulating CD8+ T-cell recruitment and activity through direct contact and/or cytokine release. I am evaluating the interactions between different cell types within the TME of Stage IIA melanoma samples. The cohort consists of relapsed N=15 vs. non-relapsed N=15, (follow-up ≥ 12 months). I have utilised the PhenoCycler to enable profiling of the complex TME using high-plex protein identification. My bespoke antibody panel consists of 37 markers which enable visualisation of multiple cell types, including melanoma cells, cancer-associated fibroblasts and leukocytes. Imaging of the cohort has been completed and now work is ongoing to analyse the images. In addition to spatial data, I will extract RNA from melanoma samples and analyse the transcriptome. This provides an overview of the gene expression profile within the tissue and offers further insight into cellular interactions.

Wind assist, weather routing, and BVs: a new, green, optimized sailing practice for the modern shipping sector

Paulo Della Moglie

Supervisors: Prof Alice Larkin and Prof Alessandro Toffoli

The maritime industry emits approximately 3% of global CO2 emissions The International Maritime Organisation has set a target to cut these emissions by 30% by 2030. In recent years, Wind Assisted Propulsion Technologies (WAPT) are being developed to harness wind power, as it is an unlimited source of natural and green propulsion. Rotors, kites or rigid sails reduce the power required from vessels' diesel engines, cutting greenhouse gas emissions. More generally, modern sailing practices can be optimised, and fuel savings can be delivered irrespective of whether a WAPT is installed on a vessel. To this end, the BlueVisby Solution challenges the conventional "sail fast then wait" approach by coordinating ship arrivals and minimizing unnecessary fuel consumption. By synchronising vessels arrivals (ETAs) in ports with the port service rate, fuel savings up to 30% can be achieved. In addition to optimising the ETA, a shipping route can be optimised to take advantage of beneficial weather conditions. The BlueVisby Solution (BVS), weather routing and WAPT have all independently demonstrated significant fuel savings, but their combined application can potentially lead to greater reductions in fuel consumption. In this presentation, a method to understand the potential fuel savings arising from a combined approach, involving arrival optimization (BVS), weather routing and wind assist propulsion is discussed. With the BlueVisby algorithm determining an optimized ETA, a vessel's route can be strategically adjusted to harness wind power more effectively while ensuring the scheduled ETA is respected.

A global study of marine cloud particle size distributions: bridging aircraft data and climate model assumptions

Larry Ger Aragon

Supervisors: Dr Yi Huang and Jonathan Crosier

Marine boundary layer clouds play a crucial role in Earth's energy and water budget, making their accurate representation in climate models essential. A key aspect of this representation involves assumptions about the shape of cloud particle size distributions (PSDs). Our study evaluates the common assumption of a fixed PSD shape parameter used in climate models for simulating marine clouds, using aircraft observations from multiple global field campaigns. Our findings reveal that marine low-level clouds generally have narrower PSD structures and are more reflective than assumed in models. This suggests that current climate simulations may underestimate the albedo (reflectivity) of marine boundary layer clouds. The global scope of our study, covering diverse oceanic regions and environmental conditions, provides robust evidence for the need to revisit how

cloud microphysical properties, particularly cloud PSDs, are represented in climate models. Incorporating these findings could address biases in large-scale models, particularly for abundant marine boundary layer clouds, and refine our understanding of Earth's climate system.

Automatic algorithm configuration under streaming problem instances

Margherita Battistotti

Supervisors: Prof Manuel Lopez-Ibanez and Prof Kate Smith-Miles

Automatic Algorithm Configuration (AAC) refers to a variety of techniques used to automatically configure the internal parameters of an algorithm, i.e. hyperparameters, so it optimizes its performance on specific problem instances or over a class of problems. AAC is of fundamental interest in many fields relying on algorithmic outputs because the human-informed, manual setting of hyperparameter values is a time-consuming process. Moreover, it usually requires the decision-maker to possess some domain knowledge, and even experts may struggle to find the combination that yields optimal results. A by-hand approach seems even more unreasonable when, potentially, the admissible hyperparameter combinations are infinitely many, or when there are many instances to be solved sequentially, i.e. a stream of instances. In fact, even when an apparently suitable configuration is found, generalizing the result for new unseen problem instances is not straightforward. Thus, an ideal algorithm configurator must be able to produce instance-specific configurations, that are at the same time robust across classes of problems of the same domain. It must be able to optimize multiple configuration objectives simultaneously, such as the algorithm runtime and the quality of the solution the algorithm produces. Furthermore, it must “keep learning” and adapting when dealing with a stream of instances that may evolve over time, as happens in real-world applications.

Water, water everywhere, nor any drop to drink: the struggle for safe drinking water in India

Akshay Kashyap

Supervisors: Prof Meenakshi Arora and Dr Laura Richards

Fluoride contamination in groundwater poses significant public health risks in West Bengal, India, with levels exceeding the WHO permissible limit of 1.5 mg/L. This study evaluates the performance of community-based drinking water purification plants across 34 villages in the Bankura and Purulia districts. Pre-filtration fluoride concentrations ranged from 1.67 mg/L to 8.21 mg/L, averaging 3.66 mg/L, while post-filtration levels showed inconsistent reductions, ranging from 1.55 mg/L to 8.10 mg/L with an average of 3.68 mg/L. Despite the government’s efforts to install filtration systems, fluoride removal efficiency remained limited, with 0% of tested samples meeting safe drinking water standards post-treatment. Additionally, Total Dissolved Solids (TDS) and conductivity levels slightly increased post-filtration, suggesting potential leaching from filter media. These findings highlight the need for improved filtration technologies tailored to the region's unique geochemical composition coupled with regular maintenance of these systems. The study underscores the importance of continuous monitoring and optimization of water purification systems to ensure safe drinking water access in fluoride-affected regions.