MCR Graduate Conference 2024

Celebrating Research at Jesus College

9 March 2024
Jesus College Cambridge

Welcome!

Welcome to Jesus College MCR Graduate Conference and Reunion 2024!

Conference Schedule

Time	Session	Location
10:00 – 10:15	Registration and refreshments	West Court Foyer
10:15 – 10:30	Conference start	Frankopan Hall
10:30 – 11:00	*Keynote:* Dr Siddharth Soni	Frankopan Hall
11:00 – 12:00	Presentation session 1	Frankopan Hall
12:00 – 13:00	Poster presentations and buffet lunch	Elena Hall
13:00 – 14:00	Presentation session 2	Frankopan Hall
14:00 – 15:00	Routes into Academic Careers Panel	Frankopan Hall
15:00 – 15:30	Afternoon refreshments	West Court Foyer
15:30 – 16:30	Presentation session 3	Frankopan Hall
16:30 – 17:00	*Keynote:* Dr Jonnie Penn	Frankopan Hall
17:00 – 17:30	Prize giving ceremony	Frankopan Hall
18:30 – 19:00	Pre-dinner drinks	Master's Lodge
19:00 -	Dinner	Upper Hall

Acknowledgements

I would like to express my gratitude to the students, Fellows and staff of Jesus College Cambridge who played a pivotal role in organising the MCR Graduate Conference – this day would not have been possible without you. My thanks go out to the MCR Committee as well as Nikki Williams and Gracie Breen from the Development and Alumni Relations Office, for their generous support, meticulous planning and ensuring the smooth execution of the conference. A heartfelt appreciation is extended to the Graduate Tutors, Professor Tim Wilkinson, Dr Michael Edwards, and Dr Sybil Stacpoole, and the Senior Postgraduate Administrator, Vanessa Bowman, who provided invaluable guidance and substantial financial support, facilitating the seamless organization of this event. A special thanks goes to the College Master, Ms Sonita Alleyne, who is kindly hosting the event's drinks reception, and whose enthusiastic support resonates deeply within the student community. We are also extremely grateful to the College's Catering and Conference departments, especially Alexis Moreau, who worked diligently behind the scenes. I extend my sincere thanks to the Careers Office, Clelia McElroy and Sarah Richey, and the panel speakers for helping to create a collaborative and engaging environment. Finally, my biggest thanks go out to all of you: our distinguished keynote speakers, presenters, and attendees. Thank you for sharing your expertise, for your active participation and curiosity and for making the conference a dynamic platform to celebrate research. We very much look forward to learning about your research!

Eleni Papafilippou
Jesus College MCR Academic Officer, 2023/24

Keynote Speech 1

10.30-11.00
Frankopan Hall

Simulated Intimacies

Dr Siddharth Soni
Lecturer in Literature and Digital Culture
University of Southampton

The lecture considers the multiple ways in which (digital) simulation of intimacy is proposed as an antidote to loneliness, whether this is animatronic robots that produce intelligible sounds, Cognitive Behavioural Therapy apps like Woebot, or full-fledged artificial companions like Replika, that are based on foundational language models. What form of a computational therapeutic this is, and what 'form' of the human does it project on all of us? Using a wide array of scholarship in literature, psychology, and philosophy of mind and cognition, as well as discourse surrounding two germane moments, a) responses to Joseph Weizenbaum's 1966 'chatter bot' ELIZA and b) those to Ishiguro's artificial friend 'Klara' in the 2021 novel *Klara and the Sun* (2021), I will attempt, in this lecture, to examine the politics of 'simulated' intimacy.

Presentation Session 1

11:00-12:00

Frankopan Hall

Jeanne Lefévère-Loide
Role of Non-Muscle Myosin in Peripheral Actin Network Remodelling at Mitotic Exit

Albert van Wijngaarden
Our Last Hope to Stop the Thaw or a Neocolonialist Distraction?: Geoengineering Research in the Polar Regions between Conflicting Considerations of Urgency and Justice

Katie Sparling
Optimisation of Clone TAMeR: a Clonal Lineage Tracing Method to study Tumour Heterogeneity

Thieme Schmidt
DNA nano actuator

Role of Non-Muscle Myosin in Peripheral Actin Network Remodelling at Mitotic Exit

Jeanne Lefévère-Laoide,[1*] Ewa Paluch[1]
* Corresponding author: jl2276@cam.ac.uk

[1] Department of Physiology Development, and Neuroscience. University of Cambridge, United Kingdom.

***Keywords**: Cell biology, cell division, cytoskeleton, actomyosin cortex, live microscopy.*

The shape of a cell is paramount to its life, as it enables it to achieve the functions for which is it specialised. Cell shape heavily relies on an ensemble of proteins called the cytoskeleton – the cell's skeleton – which is a dynamic scaffold of filaments located under the cell membrane to support it. Both the microscopic architecture and the dynamics of the cytoskeleton affect cell shape at a local and global level. My project looks at the subset of the cytoskeleton made up of the protein actin.

Here, I use the cell shape transition occurring at the end of cell division (mitosis) as a model to observe how active remodelling of actin architecture drives these changes in cell shape. During mitosis, most cells round up to allow for the division machinery to take place at the centre of the cell, supported by a change in the architecture and contractility of the cell's actin cortex (Taubenberger et al., 2020). Contractility within the actin cytoskeleton is mediated by a molecular motor called non-muscle myosin (Salbreux et al., 2012). At the end of mitosis, cells spread out again.

In this work, I focus on the role of myosin in actin cytoskeleton architecture remodelling at cells exit from mitosis, through a combination of 2D and 3D live-cell microscopy and mechanical approaches. I look at non-muscle myosin II through the double lens of contractility and protrusivity (Betapudi, 2010). Overall, this work arches over molecular and cellular scales to provide an understanding of the cytoskeletal network remodelling occurring at mitotic exit.

References

[1] Betapudi, V. (2010). Myosin II motor proteins with different functions determine the fate of lamellipodia extension during cell spreading. PLoS ONE, 5(1). https://doi.org/10.1371/journal.pone.0008560
[2] Salbreux, G., Charras, G., & Paluch, E. (2012). Actin cortex mechanics and cellular morphogenesis. Trends in Cell Biology, 22(10), 536–545. https://doi.org/10.1016/j.tcb.2012.07.001
[3] Taubenberger, A. V., Baum, B., & Matthews, H. K. (2020). The Mechanics of Mitotic Cell Rounding. Frontiers in Cell and Developmental Biology, 8(August), 1–16. https://doi.org/10.3389/fcell.2020.00687

Our Last Hope to Stop the Thaw or a Neocolonialist Distraction?: Geoengineering Research in the Polar Regions between Conflicting Considerations of Urgency and Justice

Albert van Wijngaarden[1*]
* Corresponding author: awv20@cam.ac.uk

[1] Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge, United Kingdom.

***Keywords**: Climate Change, Geoengineering, Polar Regions, Values in Science, Climate Change Mitigation*

As the effects of climate change become more pronounced and global emission mitigation schemes fail to materialize quickly enough, a growing sense of urgency is permeating climate discussions. At the same time, such discussions also increasingly focus on various notions of justice (global, indigenous, procedural etc.) and warn against the reproduction of past colonial and exploitative patterns in climate strategies. In my presentation I will analyze how considerations of justice and urgency interact and diverge when they are mobilized in arguments around the possibility to artificially “intervene” in the climate system of the Polar Regions. As I am still in the first year of my PhD, and have not yet conducted my ethnographic fieldwork, for this presentation I mainly rely on previously gathered data and an analysis of the published literature. My preliminary results however already clearly show the importance of such an analysis as the conflicting values that underlie discussions around geoengineering to a large extent seem to shape the way these topics are presented and discussed. I therefore argue that such an exploration of held values should be a key element of informed decision-making processes and will be indispensable in future discussions on which climate strategies to pursue in the Polar Regions.

Optimisation of Clone TAMeR: a Clonal Lineage Tracing Method to study Tumour Heterogeneity

Katie Sparling,[1,2*] Kirsty Sawicka,[1] Ian Cannell,[1] Greg Hannon[1]
* Corresponding author: katherine.sparling@cruk.cam.ac.uk

[1] Departmental affiliation. Cancer Research UK Cambridge Institute, University of Cambridge, Li Ka Shing Centre, Robinson Way, Cambridge. CB2 0RE. UK.
[2] Departmental affiliations. Jesus College, University of Cambridge. CB5 8BL. UK.

Keywords*: tumour heterogeneity, clonal barcoding, CRISPRa/dCas9, lineage tracing, breast cancer.*

Tumour heterogeneity, marked by a diverse array of clonal subpopulations, presents a formidable challenge in cancer treatment.[1] The strategic characterization, identification, and tracking of clonal lineages within tumours will contribute to our understanding of how tumour cells respond to existing chemotherapy regimens, holding profound implications for patient treatment strategies. The aim of this work is to optimise a clonal barcoding technique called Clone TAMeR (Transcriptional Activated Mediated Recovery), which employs the use of the CRISPRa/dCas9 system to barcode a heterogenous cell population and selectively identify clones of interest for screening for additional druggable vulnerabilities.

I aim to incorporate a library of single-guide RNA (sgRNA) constructs into a heterogenous tumour cell population derived from the D2A1 mouse mammary breast cancer cell line containing the dCas9 protein.[2] In addition to their inherent function as dCas9 guides, the sgRNA constructs act as unique cellular barcodes and contain additional capture sequences which allow for clonal lineage tracing to be combined with transcriptomic analysis. As such, single cell RNA sequencing of heterogenous Clone TAMeR cell populations, post therapeutic intervention, will provide transcriptomic information and identify the unique clonal barcodes which are of interest for further analysis. Fluorescent CRISPRa reporter constructs will be strategically designed based on these unique clonal barcodes to facilitate the specific isolation and sorting of clones of interest, enabling a comprehensive exploration of druggable vulnerabilities within these clones. Illuminating sensitivities in resistant subclones within heterogeneous tumours can inform current clinical practices and contribute to ongoing efforts to improve patient outcomes.

References:

[1] M. Raatz, S. Shah, G. Chitadze, M. Brüggemann, A. Traulsen, The impact of phenotypic heterogeneity of tumour cells on treatment and relapse dynamics, PLOS Computational Biology 17(2) (2021).
[2] S. A. Wild, I. G. Cannell, K. Kania, A. Nicholls, D. Bressan, G. J. Hannon, K. Sawicka, Clonal Transcriptomics Identifies Mechanisms of Chemoresistance and Empowers Rational Design of Combination Therapies (2021).

DNA nano actuator

Thieme Schmidt[1*]
* Corresponding author: tts26@cam.ac.uk

[1] Cavendish department, Cambridge university, United Kingdom.

***Keywords**: DNA origami, nanoactuator, polymer muscle*

The development of nanoscale robotic systems holds significant promise for a wide range of applications, including precise manipulation and assembly tasks at the molecular level. In this study, we present a novel approach to constructing a nano robotic arm for tweezer-like manipulation by combining a DNA scaffold and a polymer muscle. The resulting nanoscale robotic arm represents a breakthrough in nanotechnology and bioengineering, offering unparalleled precision and control in manipulating micro and nano-sized objects.
The DNA scaffold provides the structural framework for the robotic arm, offering a highly specific and programmable platform for the attachment of functional components. The sequence of the DNA scaffold can be tailored to create a desired arm morphology, enabling customized designs for various applications. The polymer muscle serves as the actuator, allowing controlled and responsive movements of the robotic arm. The polymer muscle contracts and relaxes in response to external stimuli, heat, providing the necessary force to manipulate objects.
The integration of the DNA scaffold and polymer muscle results in a highly versatile and adaptable nanoscale robotic system. By exploiting the programmability of DNA and the responsiveness of the polymer muscle, the robotic arm can be precisely controlled move and interact with objects at the nanoscale. This technology opens new avenues for applications in fields such as nanomedicine, nanofabrication, and advanced materials science, where fine manipulation and assembly of nanoscale components are critical. The presented nano robotic arm represents a significant advancement in the development of precise and versatile nanoscale manipulation tools.

References:
[1] S.Y. Toh, K.S. Shyuan, S.K. Kamarudin, W.R.W. Daud, Graphene production via electrochemical reduction of graphene oxide: synthesis and characterisation, Chem. Eng. J. 251 (2014) 422-434.

Poster Presentations

12:00-13:00

Elena Hall

Katrina Rorhus
Reevaluating Archaeological Types: A Case Study from Cueva de la Cocina, Spain

Kiran Kang
Safety and efficacy of very high-power short duration (vhpsd) radiofrequency ablation in a UK cohort using the qdot micro catheter

Sara Crozier
Life of volcanic crystals revealed by variations in Fe isotopes

Fiamma Berardi
Magnetic and magnetocaloric performances of frustrated fcc lanthanide oxides

Shrey Shah
Crunching the Numbers of In Vivo Bite Forces: Evaluating the Safety of Post-Surgical Dietary Advice

Danielle Sicotte
Chemical Characterization of Archaeobotanical Charred Remains

Alex Gower
Early Theoretical Results in the Operational Mechanism of Oscillator Ising Machines

Leonie Lorenz
How vaccines shape the population genetics of Streptococcus pneumoniae: A mathematical model for understanding the mechanisms and predicting the development

Baptiste Vauléon
Investigating actin dynamics during epithelial-to-mesenchymal transition

Jesus College MCR Graduate Conference and Reunion 2024

Reevaluating Archaeological Types: A Case Study from Cueva de la Cocina, Spain

Katrina Rorhus[1]*
* Corresponding author: kmr71@cam.ac.uk

[1] Department of Archaeology, University of Cambridge, United Kingdom.

Keywords: *Mesolithic, computational archaeology, stone tools*

Archaeological types are frameworks used in archaeology to group artefacts into “cultures” that can be tracked through space and time. These types can be geographically or chronologically broad, like “Acheulean handaxes”, which are seen from 1.7 million to 200,000 years ago across Africa, Europe, and Asia, or very restricted, like “Solutrean laurel leaf points”, which are only found in southwestern France and northern Spain for 5000 years during the Upper Paleolithic. These types are determined by the characteristics of the artefacts, including the shape, size, material, or decorations on the artefacts. Although types are essential in archaeological interpretation, they are assigned by humans that are prone to errors, assumptions, and biases. In this project, I analyse over 3000 geometric microliths from Cueva de la Cocina, Spain, which can be typed according to three archaeologists’ frameworks- Fortea[1], Juan Cabanilles[2] and Garcia-Puchol[3].

Using both supervised and unsupervised clustering methods, I look at how the three different frameworks compare to each other and explore how a computer model would group the lithics based only on their morphology.

References:
[1] Fortea Perez, F. J. (1973) Los complejos microlaminares y geometricos del epipaleolitico mediterraneo espanol. Spain: Salamanca
[2] Juan Cabanilles, J. (2008). El utillaje de piedra tallada en la Prehistoria reciente valenciana: Aspectos tipológicos, estilísticos y evolutivos. Valencia: Servicio de Investigación Prehistórica
[3] García Puchol, O. (2005). El proceso de neolitización en la fachada mediterránea de la península Ibérica. Tecnología y tipología de la piedra tallada (Vol. 1430). Oxford: BAR International Series.

Jesus College MCR Graduate Conference and Reunion 2024

Safety and efficacy of very high-power short duration (vhpsd) radiofrequency ablation in a UK cohort using the qdot micro catheter

Kiran Kang,[1*] Dr.Sarah Zeriouh ,[1,2], Dr. Claire Martin[2]
* Corresponding author: kk725@cam.ac.uk

[1] Department of Medicine, Papworth Hospital, University of Cambridge, United Kingdom.

***Keywords**: Atrial-Fibrillation, Ablation, HPSD, Radiofrequency*

Introduction: Radiofrequency (RF) is the most common form of ablation used in atrial fibrillation (AF). Conventional forms of RF ablation utilise low power for long durations. HPSD is an alternative first introduced in 2006. We examine the safety and efficacy of the novel QDOT Micro catheter.

Methods: All patients undergoing vHPSD RF ablation at a single UK centre were included in a prospective registry. Patients with additional ablation lines (other than CTI) were excluded. Clinical data was collected prior to ablation, procedural data analysed, and post-ablation complications, and AF recurrence post 90-day blanking period were recorded.

Results: 27 patients (table 1) were treated between January 2023 and January 2024. 37% of cases used deep sedation with fentanyl and midazolam, all other cases were done under GA. Average procedure time was 163 +/- 44 minutes with an average fluoroscopy time of 22.3 +/- 14.7 minutes.

Male	77.8%
Female	22.2%
Paroxysmal	66.7%
Persistent	33.3%
Primary Episode of Persistent	3.7%
Age	64 +/- 11
Weight (kg)	89 +/- 17
Height (cm)	176 +/- 9
BMI (kg/m^2)	28.6 +/- 5

Table 1

4 pulmonary veins were isolated in all cases. There were no pulmonary vein reconnections. First pass isolation (FPI) was 69.2% in the lpvs and 73.1% in the rpvs.

The safety profile shows 3 complications all subsequently resolving. These being 2 (7.4%) pericardial effusions and one cardiac tamponade (3.7%). Freedom from AF was 83.3% in the 18 patients who had received a check-up post 90-day blanking period.

Conclusion: The QDOT micro has a good safety profile with 2 pericardial effusions and one cardiac tamponade in 27 cases, with a perfect acute efficacy (100%). 6-month efficacy is comparable to low-power long duration RF ablation.

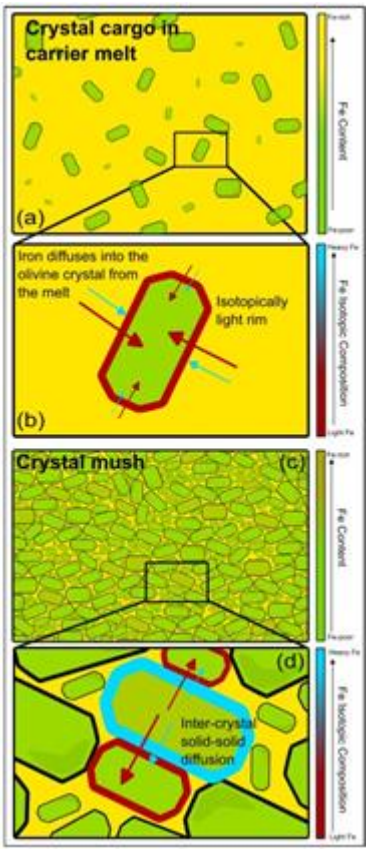
Jesus College MCR Graduate Conference and Reunion 2024

Life of volcanic crystals revealed by variations in Fe isotopes

Sara Crozier,[1*] Helen Williams,[1] Simon Matthews,[2] Oli Shorttle[1]
* Corresponding author: sgc48@cam.ac.uk

[1] Department of Earth Sciences. University of Cambridge, United Kingdom.
[2] Institute of Earth Sciences, School of Engineering and Natural Sciences, University of Iceland, Iceland.

***Keywords**: Fe isotopes, storage, mush, diffusion, kinetic.*



The upper mantle exhibits chemical and isotopic heterogeneity, with iron isotopes serving as vital indicators for distinguishing mantle source lithologies. However, conventional equilibrium mass-dependent stable iron isotope fractionation models fail to capture the full extent of natural variation, suggesting contribution from disequilibrium processes like kinetic isotope exchange via inter-mineral diffusion or open system transfer (Soderman, 2022).

Diffusion induces fractionation as isotopes diffuse at varying rates based on their masses. The assumption of diffusion ubiquity is crucial in employing diffusion profiles for chronometry, although previous methods often focus on major elements or volatiles in melt inclusions. Diffusion-driven processes can lead to isotopic zonation and signature modification (Costa et al., 2020).

Olivines, rock-forming minerals rich in Fe and Mg, offer insights into volcanic plumbing systems, with mush regions often serving as open systems susceptible to disequilibrium through processes like magma recharge, mixing, and reactive porous flow, though distinguishing these environments using isotopic investigations has thus far been difficult.

This study focuses on Fe isotopic compositions of olivines, measured via mineral separation, column chromatography, and LA-ICP-MS, to understand how mantle signatures endure or evolve during crustal processes. A novel method visualises diffusion fractionation models in 3-isotope space (McCoy-West et al., 2018), assessing the environments conducive to diffusion-driven profiles, that being a crystal mush vs magma setting (See Figure). The study underscores that the natural dataset defies explanation solely through equilibrium or disequilibrium processes, stressing the need for further research to comprehensively grasp the observed variation and characterise the parameters governing Fe diffusion.

References:
[1] Soderman. A heavy stable isotope approach to tracing mantle source and process. PhD thesis, University of Cambridge, 2022.
[2] Costa, F., Shea, T. and Ubide, T. (2020) ‘Diffusion Chronometry and the timescales of Magmatic Processes’, Nature Reviews Earth & Environment, 1(4), pp. 201–214
[3] A. J. McCoy-West, J. G. Fitton, M.-L. Pons, E. C. Inglis, and H. M. Williams. The Fe and Zn isotope composition of deep mantle source regions: Insights from Baffin Island picrites. Geochimica et Cosmochimica Acta, 238:542–562.

Jesus College MCR Graduate Conference and Reunion 2024

Magnetic and magnetocaloric performances of frustrated *fcc* lanthanide oxides

Fiamma Berardi,[1*] EliseAnne C. Koskelo,[1,2] Liam A. V. Nagle-Cocco,[1] Camilla Tacconis,[1] Xiaotian Zhang,[1] Cheng Liu,[1] Siân E. Dutton[1]
* Corresponding author: fb560@cam.ac.uk

[1] Cavendish Laboratory, University of Cambridge, JJ Thomson Avenue, Cambridge, CB3 0HE
[2] Department of Physics, Harvard University, Cambridge, MA 02138, USA

***Keywords**: magnetocaloric effect, magnetic frustration, solid-state refrigeration, lanthanide oxides, superexchange*

It is crucial to explore magnetic refrigeration as an alternative to vapour-compression refrigeration because the latter requires greenhouse gases, ozone depletors and/or gases from finite sources, such as helium. Nowadays, liquid He and 3-He are most commonly used to achieve cryogenic temperatures. Magnetically frustrated compounds are promising candidates for solid-state refrigeration because their magnetocaloric performances are enhanced due to the suppressed ordering temperatures, high magnetic moments, large ground state entropy, and minimal nearest-neighbour (*nn*) spin interactions.

Gadolinium oxides with a double perovskite structure in frustrated *fcc* lattices remain a relatively new field of research and are less investigated than the garnet and pyrochlore lattice analogues. Here we aim to investigate the role of d^0 and d^{10} ions on the lanthanide superexchange by comparing the performances of two families of *fcc* gadolinium oxides: A_2GdNbO_6 and A_2GdSbO_6 (A = {Ba, Sr, Ca}). Zero field cooled (ZFC) magnetic susceptibility measurements on A_2GdNbO_6 compounds show that there is no evidence of magnetic ordering down to 1.8 K, indicating minimal short-range correlations.

The compounds adhere well to the predicted Curie-Weiss behaviour for free uncoupled spins, with small ferromagnetic (Ba_2GdNbO_6) and antiferromagnetic (Sr_2GdNbO_6 and Ca_2GdNbO_6) deviations. The experimental effective magnetic moments of all compounds are in good agreement with the theoretical value for Gd^{3+} ions. Ca_2GdNbO_6 is found to be site-disordered, and the tuneability of its disorder is investigated in order to minimise the degree of correlations. The overall results suggest that *fcc* gadolinium oxides are ideal candidates for the design of next generation magnetocaloric materials.

References:

[1] E. C. Koskelo, C. Liu, P. Mukherjee, N. D. Kelly and S. E. Dutton, *Chemistry of Materials*, 2022, **34**, 3440-3450.
[2] P. Xu, Z. Ma, P. Wang, H. Wang and L. Li, *Materials Today Physics*, 2021, **20**, 100470.
[3] A. H. Olafsdottir and H. U. Sverdrup, *Biophys Econ Sust*, 2020, **5**, 1-18.

Crunching the Numbers of In Vivo Bite Forces: Evaluating the Safety of Post-Surgical Dietary Advice

Shrey Shah[1,2*], Sven Wilhelm Odelberg[3], Adrian Kearns[3],
Vijayrajan Santhanam[3], Michael Sutcliffe[1]
* Corresponding author: sas244@cam.ac.uk

[1]Departmental affiliation. Department of Engineering, University of Cambridge, Cambridge
[2]Departmental affiliations. Jesus College, University of Cambridge, Cambridge
[3]Departmental affiliations. Department of Maxillofacial Surgery, Addenbrooke's Hospital, Cambridge

Keywords*: Oral and Maxillofacial Surgery, Masticatory Forces, Mandibular Fixation, Plate Failure, Dietary Guidelines*

Surgical implant fixation of jawbone discontinuities is one of the most common techniques employed in mandibular surgery. This project aims to create a custom medical device to measure the force produced when masticating different food items, to provide data-backed post-surgical dietary guidelines and to assess implant impact. Current research lacks information on the impact of different foods on the stresses exerted on mandibular plates.

To surgically treat discontinuities in the jawbone, bone fragments are fixated using plates and screws, minimising movement, and allowing bone remodelling and repair - it typically takes six weeks to regain full load-bearing strength.[1] During this phase, excessive jaw, like mastication, loading poses a significant risk by potentially compromising the bone fixation of screws, leading to deformation, plate failure, and displacement of the bony segment out of ideal fracture alignment.[2]

To minimise risk, patients are advised to follow post-surgical `soft food' diets during the initial healing phase, focusing on consuming easily chewable foods or liquids; however, current guidelines are anecdotal, vague, and contradictory, potentially exposing patients to the risk of plate failures from excessive masticatory forces.[3]

My project involves developing a minimally intrusive force sensor mouth splint to record the forces required to masticate different food items and designing a Finite Element Model to establish critical masticatory force thresholds for implant damage. This enables a comparison with experimental data from different food categories, to validate or refute existing dietary guidelines and to create evidence-based guidelines to correctly advise patients of what they can and cannot eat.

References:

[1] Mayo Clinic Jaw Surgery https://www.mayoclinic.org/tests-procedures/jaw-surgery/about/pac-20384990 Accessed: August 15 2023.

[2] Merema, B. et al. Novel finite element-based plate design for bridging mandibular defects: Reducing mechanical failure https://onlinelibrary.wiley.com/doi/full/10.1111/odi.13331 Accessed: September 01 2023.

[3] Oxford University Hospitals NHS Trust Oral and Maxillofacial Surgery: Jaw Surgery Information for Patients https://www.ouh.nhs.uk/patient-guide/leaflets/files/121105jawsurgery.pdf Accessed: September 09, 2023.

Jesus College MCR Graduate Conference and Reunion 2024

Chemical Characterization of Archaeobotanical Charred Remains

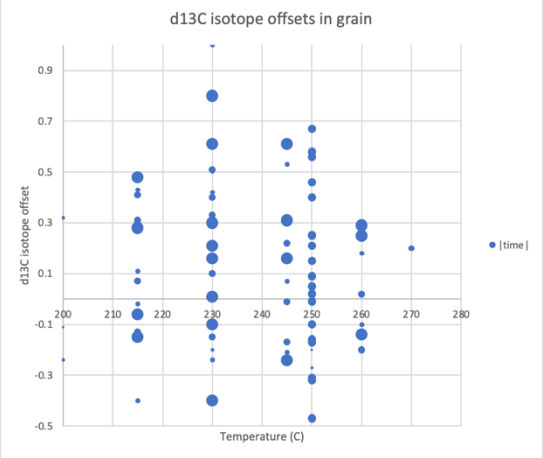
Danielle Sicotte[1]
Corresponding author: ds2017@cam.ac.uk

[1] Department of Archaeology. University of Cambridge, United Kingdom.

***Keywords**: Stable Isotopes, Archaeobotany, Carbonization, Infrared Spectroscopy, Scanning Electron Microscopy*

It has been suggested that the $\delta^{13}C$ and $\delta^{15}N$ ratios of plant remains is affected by the charring process, stipulating the need for accurate isotopic "offsets" to relate the $\delta^{13}C$ and $\delta^{15}N$ values to that of the original plant.[1–4] Contrary to what has been widely practiced in literature, an isotopic offset is not calculable based solely on charring temperature and time, as there is no discernible relationship between these variables (Figure 1).

This project seeks to combine SEM, FTIR, and NIR analyses of differently charred archaeological plant remains recovered from the Danebury Hillfort site to better characterize charred plant remains. FTIR and NIR analyses will be applied to observe the chemical compositions across the differently charred remains. SEM will then relate the chemical composition to the visual assessment of the charred condition of the archaeological plant remains.



Through this combined analysis, the efficacy of a calculated isotopic offset will be assessed to determine its reliability to accurately reconstruct the original $\delta^{13}C$ and $\delta^{15}N$ values.

Figure 1: The combined data of modern grain charring experiments including millet, emmer, barley, spelt, wheat, and einkorn.[1–4] The $\delta^{13}C$ isotopic offsets were plotted against the charring temperature (C) with the length of charring portrayed by the size of the data point (the larger the point, the longer the charring time).

References:

[1] Fiorentino, G. et al. Studying Ancient Crop Provenance: Implications from δ13C and δ15N Values of Charred Barley in a Middle Bronze Age Silo at Ebla (NW Syria). *Rapid Communications in Mass Spectrometry* **2012,** *26 (3), 327-335.*

[2] Fraser, R. et al. Assessing Natural Variation and the Effects of Charring, Burial and Pre-Treatment on the Stable Carbon and Nitrogen Isotope Values of Archaeobotanical Cereals and Pulses. *Journal of Archaeological Science* **2013,** *40*(12), 4754-4766.

[3] Varalli, A. et al. Charring Effects on Stable Carbon and Nitrogen Isotope Values on C4 Plants: Inferences for Archaeological Investigations. *Journal of Archaeological Studies* **2023,** *156,* 105821.

Early Theoretical Results in the Operational Mechanism of Oscillator Ising Machines

Alex Gower[1,2]
* Corresponding author: email@address.uk
[1] TCM Group, Cavendish Laboratory, University of Cambridge, Cambridge CB3 0HE, United Kingdom
[2] Nokia Bell Labs, United Kingdom

***Keywords**: Artificial Intelligence, Combinatorial Optimization, Unconventional Computing, Ising Machines, Neuromorphic Computing*

Oscillator Ising Machines are a type of Ising machine i.e. their aim is to optimise the Ising Hamiltonian, an NP-complete problem whose efficient solution in the general case would allow for efficient solutions of all NP-hard problems which would be significant in the fields of optimisation and AI.

OIMs optimise the Ising Hamiltonian by exploiting the dynamics of coupled self-sustaining nonlinear oscillator networks. In essence, the (J_ij , h_i) variables of the Ising problem are mapped onto the coupling strengths between oscillators i and j, and a sub-harmonic injection locking procedure is used to discretise the oscillator phases into sets of oscillators which are in phase and anti-phase with respect to the driving oscillation (corresponding to s_i = ±1). The equilibrium phase configuration can then be shown to locally optimise the Ising Hamiltonian. One major advantage of OIMs is that they are hardware-agnostic and can be practically realised using many different types of physical oscillator. This notably includes implementations using CMOS integrated circuits, a low-power and easily miniaturisable/scalable technology with extremely well established development and manufacturing processes. Initial empirical results suggested OIMs (and simulations of OIMs) demonstrated state-of-the-art performance in solving frustrated loop and MAX-CUT Ising problems.

New theoretical results demonstrate that the dynamics of OIMs can be described as a stochastic gradient descent process on an energy landscape in an expanded XY rotor configuration space. In the case of static hyperparameters, this means that the equilibrium configuration probability distribution is Boltzmann, favouring globally low energy solutions for low temperatures (noise).

References:

[1] Wang, T. and Roychowdhury, J., 2019. OIM: Oscillator-based Ising machines for solving combinatorial optimisation problems. In *Unconventional Computation and Natural Computation: 18th International Conference, UCNC 2019, Tokyo, Japan, June 3–7, 2019, Proceedings 18* (pp. 232-256). Springer International Publishing.

How vaccines shape the population genetics of *Streptococcus pneumoniae*: A mathematical model for understanding the mechanisms and predicting the development

Leonie J. Lorenz[1,2*], Joel Hellewell[1], Nicholas Croucher[3], John A. Lees[1]
* Corresponding author: llorenz@ebi.ac.uk

[1] European Bioinformatics Institute (EMBL-EBI), Wellcome Genome, Hinxton CB10 1SD, UK.
[2] Jesus College, University of Cambridge, Jesus Ln, Cambridge CB5 8BL, UK.
[3] Faculty of Medicine, School of Public Health, Imperial College London, Medical School Building, St Mary's Hospital, Norfolk Place, London W2 1PG, UK.

***Keywords**: Infectious Diseases, Mathematical Modelling, Streptococcus pneumoniae.*

Streptococcus pneumoniae is a human pathogen that populates the nasal cavity and the respiratory tracts. While many healthy humans carry it asymptomatically, *S. pneumoniae* occasionally turns pathogenic and causes diseases such as pneumonia and sepsis, with a high burden of disease especially in young children and low-income countries.

Vaccines against *S. pneumoniae* have been developed, reducing the burden of disease and imposing a new selection pressure on the *S. pneumoniae* population. It is crucial to understand the post-vaccine population development of S. pneumoniae to avoid a surge in prevalence of especially pathogenic strains. Based on an existing model, I am developing a mathematical model that aims to predict the changes in *S. pneumoniae* populations after the introduction of vaccines.

My model can be used to simulate the effect of existing and theoretically possible vaccines and answer an array of other questions. Currently, I am investigating whether whole genome sequences are essential to predict the population genetics of *S. pneumoniae* or whether the more accessible, less costly serotyping is sufficient.

Jesus College MCR Graduate Conference and Reunion 2024

Investigating actin dynamics during epithelial-to-mesenchymal transition

Baptiste Vauléon[1*], Iskra Yanakieva[1], Ruby Peters[1], Wolfram Poenisch[1], Tasmin Sarkany[1], Ewa Paluch[1]

* Corresponding author: bljv2@cam.ac.uk

[1] Department of Physiology, Development and Neuroscience, University of Cambridge, United Kingdom.

***Keywords**: Cytoskeleton, Cell motility, Super-resolution*

Both cell shape and cell shape transitions are crucial and tightly controlled during development and in tissue homeostasis [1]. Conversely, their dysregulation has been identified as a pivotal factor in various pathological conditions, notably cancer [2]. Shape transitions are also known to coincide with a reorganisation of the underlying acto-myosin network [3]. In fact, many of those processes appear to be driven by transitions between cortex-dominated to protrusive lamellipodia- dominated acto-myosin network. The model system I am using to study such an actomyosin remodelling is MDCK cells undergoing epithelial-to-mesenchymal transition (EMT) during which they spread [4][5].

While considerable attention has been directed towards understanding the signalling mechanisms underlying EMT-induced spreading, the mechanisms through which changes in actomyosin network architecture drive spreading remain less studied and therefore poorly understood. Another reason why the dynamics of actin and myosin remodelling during this process remains elusive stems from the limitation of the approaches used to address this transition. It is indeed often done through either three-dimensional (3D) imaging of fixed samples in few timepoints throughout EMT [6] or with live imaging, albeit limited to the basal plane of the cell [7].

The primary objective of my research project is therefore twofold: first, my goal is to provide a comprehensive understanding of the lacking 3D dynamics of actomyosin reorganisation at the whole-cell scale. Second, it is to elucidate the specific remodelling of actin structures by focusing on distinct cell domains with high temporal resolution. Ultimately, this study aims to quantitatively analyse both the global and structure-specific reorganisation of actin and myosin distributions across the cell.

References:

[1] Heisenberg, C.P. and Bellaïche, Y., 2013. Forces in tissue morphogenesis and patterning. *Cell*, *153*(5), pp.948-962.
[2] Olson, M.F. and Sahai, E., 2009. The actin cytoskeleton in cancer cell motility. *Clinical & experimental metastasis*, *26*, pp.273-287.
[3]Salbreux, G., Charras, G. and Paluch, E., 2012. Actin cortex mechanics and cellular morphogenesis. *Trends in cell biology*, *22*(10), pp.536-545.
[4] Nieto, M.A., Huang, R.Y.J., Jackson, R.A. and Thiery, J.P., 2016. EMT: 2016. *Cell*, *166*(1), pp.21-45.
[5] Bovellan, M., Romeo, Y., Biro, M., Boden, A., Chugh, P., Yonis, A., Vaghela, M., Fritzsche, M., Moulding, D., Thorogate, R. and Jégou, A., 2014. Cellular control of cortical actin nucleation. *Current Biology*, *24*(14), pp.1628-1635.
[6] Stevenson, B.R. and Begg, D.A., 1994. Concentration-dependent effects of cytochalasin D on tight junctions and actin filaments in MDCK epithelial cells. *Journal of cell science*, *107*(3), pp.367-375.
[7] Zhitnyak, I.Y., Rubtsova, S.N., Litovka, N.I. and Gloushankova, N.A., 2020. Early events in actin cytoskeleton dynamics and E-cadherin-mediated cell-cell adhesion during epithelial-mesenchymal transition. *Cells*, *9*(3), p.578.

Presentation Session 2

13:00-14:00

Frankopan Hall

Raunak Khanduja

How do transient temperature perturbations during a critical period cause long-lasting effects on neuronal function?

Julia Greenland

The effect of azathioprine on peripheral and central inflammation in Parkinson's disease: exploratory biomarker data from the AZA-PD clinical trial

Yutong Wang

A phonetic study on rime merger in Beijing retroflex suffixation

Mark Turner

Direct Thermal Management for Lithium-Ion Batteries

How do transient temperature perturbations during a critical period cause long-lasting effects on neuronal function?

Raunak Khanduja [1], Daniel Sobrido-Camean [2], Matthias Landgraf [2]

[1] Department of Clinical Medicine, University of Cambridge, United Kingdom
[2] Department of Zoology, University of Cambridge, United Kingdom

***Keywords**: Drosophila, Critical Period, Neurodevelopment, Reactive oxygen species, Genetics*

Introduction: Critical periods (CPs) are windows of heightened plasticity which occur during neurodevelopment. Perturbations confined to such a phase can have long-lasting effects on neuronal structure and function. It is speculated that perturbations during CPs underlie aetiology of neurological disorders such as autism spectrum disorder, epilepsy and schizophrenia. Our project sought to investigate principal pathways underlying CPs using the *Drosophila* larval motor system as a model.

Methods: Our approach involved a systemic temperature manipulation combined with cell-targeted genetic manipulations, allowing us to investigate effects of CP perturbations at the single-cell level. Building on previous findings that indicated an important role for reactive oxygen species (ROS) during CPs, we carried out a best candidate genetic screen focused on enzymes involved in mitochondrial energy metabolism, namely: pyruvate dehydrogenase (PDH), PDH kinase, PDH phosphatase, isocitrate dehydrogenase and citrate synthase.

Results: *Drosophila* exposed to 32°C during the CP exhibited neuromuscular junction (NMJ) overgrowth compared to animals exposed to 25°C. We found that inhibiting PDH activity (via different manipulations) resulted in partial NMJ overgrowth rescue following a 32°C CP experience. Conversely, cell targeted activation of PDH coupled with a 32°C CP experience resulted in NMJ overgrowth. Knockdown of citrate synthase and isocitrate dehydrogenase failed to rescue the 32°C CP phenotype.

Conclusions: Our results support a role for reverse electron transport (RET) in sensing CP perturbations, with PDH being important in facilitating transduction of this signal to mediate long-lasting changes to nervous system function.

The effect of azathioprine on peripheral and central inflammation in Parkinson's disease: exploratory biomarker data from the AZA-PD clinical trial

Julia Greenland,[1*] Jonathan Holbrook[1], Reiss Pal[1], Lakmini Kahanawita[1], Lennart Spindler[1], Marta Camacho[1], Caroline Williams-Gray[1]
* Corresponding author: jcg69@cam.ac.uk

[1] Department of Clinical Neurosciences, John van Geest Centre for Brain Repair, University of Cambridge, United Kingdom

***Keywords**: Parkinson's disease, clinical trial, immunosuppression*

Introduction

There is substantial evidence implicating the immune system in the development and progression of Parkinson's disease (PD). Studies have demonstrated an activated immune profile in early disease, which is predictive of disease progression [1].

Methods

We are running a randomised double-blind placebo-controlled trial of azathioprine, a peripherally acting immunosuppressant, in early PD, with the aim of slowing down disease progression (AZA-PD) [2]. At this stage, we remain blinded to treatment allocation and are unable to report on clinical outcomes. However, the exploratory "proof of mechanism" analysis has been carried out on the peripheral and central immunophenotyping data from blood and CSF and [^{11}C]-PK11195-PET/MRI imaging data.

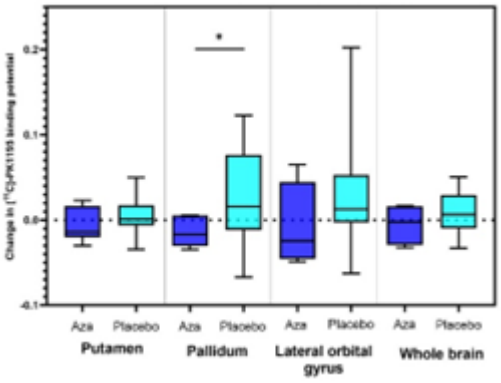


Figure 1: Change in [^{11}C] PK11195 BP_{ND} across the treatment period in the selected regions of interest and the whole brain by treatment group.

Results

As expected, there was a depletion in blood lymphocyte numbers ($p<0.0001$) following treatment, seen predominantly in the CD4+ effector cells ($p= 0.004$) and the NK cells ($p<0.0001$). Importantly, azathioprine also decreased measures of central immune activation. There was a reduction in the CSF lymphocyte count, seen across CD3+ ($p=0.020$) and NK ($p=0.037$) compartments and a reduction in classical monocytes ($p=0.023$). Analysis of [^{11}C]- PK11195 binding potentials revealed a significant reduction in neuroinflammatory signal in the pallidum ($p=0.043$) following treatment, and a consistent trend towards a reduction in neuroinflammation compared to the placebo group across multiple brain regions (Figure1).

Conclusions

As well as providing mechanistic context for the upcoming analysis of the clinical outcomes in the AZA-PD trial, this work supports the theory that it is possible to manipulate inflammation in the central nervous system through a peripherally acting immunosuppressive agent.

References:
[1] Harms, A.S., S.A. Ferreira, and M. Romero-Ramos, *Periphery and brain, innate and adaptive immunity in Parkinson's disease.* Acta Neuropathol, 2021. **141**(4): p. 527-545.
[2] Greenland, J.C., et al., *Azathioprine immunosuppression and disease modification in Parkinson's disease (AZA-PD): a randomised double-blind placebo-controlled phase II trial protocol.* BMJ Open, 2020. **10**(11): p. e040527.

A phonetic study on rime merger in Beijing retroflex suffixation

Yutong Wang,[1*] Mitko Sabev[1,2]
* Corresponding author: yw590@cam.ac.uk

[1] Department of Theoretical and Applied Linguistics, University of Cambridge, UK
[2] Department of Language Science and Technology, Saarland University, Germany

Keywords*: Beijing Mandarin, vowel merger, rime coalescence, incomplete neutralisation, retroflex suffixation*

Introduction: Incomplete neutralisation (IN) is incompatible with assumptions that phonologically-neutralised contrast should not yield surface distinctions, and therefore poses challenges to the traditional modular feed-forward phonology-phonetics interface [1, 2]. frequently-discussed evidence includes American /t/-flapping and German final devoicing, while the diminutive retroflex suffixation in Beijing Mandarin (BM) and its resultant rime merger, the intriguing pattern of which is subject to the rime type, remain under-researched.

Methods: This paper reports an experiment on 10 BM native speakers' pattern of retroflex-suffixed rimes. MANOVAs were performed for the effects of suffixation and rime identity on F_1, F_2 frequencies of nuclear vowels: pillai's trace was used as a metric of overall spectral difference to quantify the merger [3, 4]. Symmetric differences between the probability density functions of each formant frequency were computed.

Results & Conclusion: Results are reported for rimes that were previously claimed to merge: those with high, mid-unrounded, and low nuclei. With an overall shrinkage of the vowel space, suffixed nuclei are globally retracted, while high vowels tend to be moderately lowered and low vowels to be considerably raised. Our findings confirm complete acoustic neutralisation of the nuclear [a] rimes, where monophthongal rimes merge with those ending in [i, n]. The suffixed [ɤ] also exhibits complete merger with the group, into an undifferentiated [ə]. On the other hand, suffixed [ie, y, u, ei] remain acoustically distinct within their merger groups. Supported by previous perceptual findings [5], these statistically significant acoustic differences are not large enough to be perceptible, pointing to potential IN.

References:

[1] N. Chomsky and M. Halle, *The sound pattern of English*, 1st MIT Press pbk. ed. Cambridge, Mass: MIT Press, 1991.
[2] J. B. Pierrehumbert, 'Word-specific phonetics', in *Laboratory Phonology 7*, C. Gussenhoven and N. Warner, Eds., Berlin, New York: De Gruyter Mouton, 2002, pp. 101–140. doi: doi:10.1515/9783110197105.1.101.
[3] J. Nycz and L. Hall-Lew, 'Best practices in measuring vowel merger', *Proc. Meet. Acoust.*, vol. 20, no. 1, p. 060008, Dec. 2013, doi: 10.1121/1.4894063.
[4] M. Sabev, 'Unstressed vowel reduction and contrast neutralisation in western and eastern Bulgarian: A current appraisal', *J. Phon.*, vol. 99, p. 101242, 2023.
[5] Y. Wang, "Contrast neutralisation in Beijing retroflex suffixation: an acoustic study," MPhil dis- sertation, University of Cambridge, 2022.

Direct Thermal Management for Lithium-Ion Batteries

M. A. Turner[1*], D. I. Wilson[2], S. M. Clarke[1]
* Corresponding author: mt737@cam.ac.uk

[1] Institute for Energy and Environmental Flows & Yusuf Hamied Department of Chemistry, University of Cambridge, United Kingdom.
[2] Department of Chemical Engineering and Biotechnology, University of Cambridge, United Kingdom.

***Keywords**: Batteries, Electric Vehicles, Lithium-Ion, Heat Transfer.*

Faster charging of lithium-ion batteries is a major objective for overcoming motorists' concerns over electric vehicle range. However, fast charging generates large amounts of heat. High temperatures cause the batteries to degrade, lowering capacity and hence range. Low temperatures experienced in cold climates can also lead to degradation when charging or discharging. Hence, it is desirable to keep the battery temperature between 10-45°C.

Most electric cars today use indirect thermal management, where a physical barrier separates a water-based coolant, or other thermal management fluid, from the cells. The physical barrier increases thermal resistance, lowering heat transfer efficiency. Using a non-conductive or dielectric thermal management fluid means no physical barrier is required to provide electrical insulation. However, these fluids generally have less favourable physical properties for efficient heat transfer compared to water. We present some work quantifying the heat transfer performance of dielectric fluids and as part of a project to identify strategies for improvement.

Routes into Academic Careers Panel

14:00-15:00

Frankopan Hall

Our Careers Team will be hosting a ‘Routes into Academic Careers’ Panel Discussion. Chaired by Professor Stuart Clark, Director of Studies in Natural Sciences at Jesus College and current chair of the Sciences Junior Research Fellowship competition, the panel will cover a broad range of academic disciplines and academic roles across Cambridge and Anglia Ruskin University.

Confirmed panelists include:

Dr Mollie Arbuthnot
Junior Research Fellow in History and Russian Studies, Jesus College

Dr Paula Keller
Director of Studies in Philosophy, Jesus College, and winner of the Arts JRF in 2023

Dr Svetlana Menkin
Royal Society Research Fellow, Department of Chemistry

Dr Maria Duarte Rosa
Senior Lecturer Practitioner in Computer and Information Science, Anglia Ruskin University

Dr Susan Walker
Associate Professor of Contraception, Sexual and Reproductive Health, Anglia Ruskin University

Presentation Session 3

15:30-16:30

Frankopan Hall

Alastair Smith
'Queer Jihad': Islam and the Queer aesthetic in the poetry of Ozan Zakariya Keskinkılıç

Alice Paver
The influence of negative voice stereotypes on incorrect identifications in voice parades by witnesses

Oliver Wissett
Developing a fragment library for de novo design of Affibodies by fragment-based geometric deep-learning

Miraya McCoy
Alchemical Epistemologies of Extraction and Richard Eden's Decaydes of the New Worlde

‘Queer Jihad’: Islam and the Queer aesthetic in the poetry of Ozan Zakariya Keskinkılıç

Alastair Smith[1*]
* Corresponding author: als212@cam.ac.uk

[1] Faculty of Modern and Medieval Languages and Linguistics, University of Cambridge, United Kingdom.

***Keywords**: Faith, Queerness, Cruising, Space, German Literature.*

The German-language poetry of Ozan Zakariya Keskinkılıç explores the rich overlap between Islam and queer identities, enacting what Keskinkılıç and others have termed ‘Queer Jihad’. [1] Taking up the Islamic tradition of ‘struggle’ or ‘striving’ towards a goal (*jihād*), Keskinkılıç’s poetry addresses the issues of cruising, queer sex, and anti-Muslim racism through a distinctly theological lens.

Alongside close critical reading, my paper will borrow methods from a variety of literary-critical schools to better apprehend Keskinkılıç’s work. Elements of queer theory are particularly important: I use the methodological paradigm of ‘queering’ to approach ‘Queer’ and ‘Muslim’ not as static identity-markers, but as heuristic designations for the dynamic fields of faith and sexuality that ‘Queer Jihad’ addresses. Furthermore, I build on the important overlap between queer theory and space studies to examine the ways in which queer communities shape and are shaped by the communal spaces which they inhabit, and particularly the space of the swimming baths.

Overall, my research finds that ‘Queer Jihad’ involves a highly *ambivalent* engagement with the core tenets of queer theory: while Keskinkılıç’s poetry problematizes the overly simplistic and often white-supremacist notions of queer communities as a kind of ‘Whitmanesque democracy’ [2], it nonetheless offers powerful notions of togetherness and sociability. Close reading of the text reveals the extent to which these notions of sociability are bound up with Islam. Fostering a complex intertextual dialogue with the Qur’an, Keskinkılıç opens up the possibility for faith and queerness to be understood as mutually enriching, rather than contradictory forces.

References:

[1] Keskinkılıç, Ozan Zakariyah. *Muslimaniac. Die Karriere eines Feindbildes*, (Berlin: Verbrecher Verlag, 2023), p.110.
[2] Bersani, Leo. *Is the Rectum a Grave? and Other Essays*, (Chicago; London: University of Chicago Press, 2010), p.12.

The influence of negative voice stereotypes on incorrect identifications in voice parades by witnesses

Alice Paver,[1*] David Wright,[2] Natalie Braber[2]
* Corresponding author: aegp2@cam.ac.uk

[1] Theoretical and Applied Linguistics, University of Cambridge, United Kingdom.
[2] School of Arts and Humanities, Nottingham Trent University, United Kingdom.

***Keywords**: voice parades, voice stereotypes, earwitness identification, forensic linguistics*

This research explores the factors influencing the erroneous choice of foil voices in voice parades; in particular, the impact of stereotypical judgments held by listeners. A voice parade is conducted when a victim or witness to a crime is asked to identify a perpetrator from a line-up amongst similar-sounding foils. Existing research indicates that voices are subject to negative judgments in forensic contexts, with some being perceived as sounding 'more guilty' of certain criminal offenses [1,2]. This study builds on the findings of previous studies, which identified instances of inaccurate selections in voice parades [3,4]. We hypothesise that voices frequently selected in target-absent parades receive more negative ratings than those less frequently chosen.

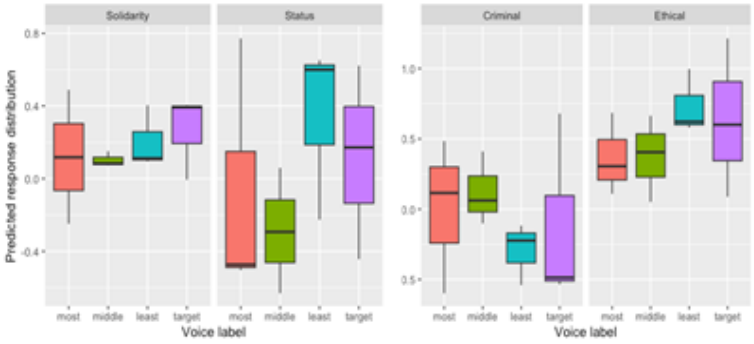


Figure 1. Predicted response distribution of z-scored ratings of social trait question types (left) and behavioural question types (right) for voices from voice parades.

180 participants evaluated twelve voices from these earlier experiments: three target speakers and nine foils. Voices were rated on ten social traits and ten behaviours, including various crimes. Regression models revealed that the most-selected foils received significantly lower ratings on status and solidarity traits compared to the target speaker (fig 1). Moreover, they were rated significantly higher for the likelihood of criminal behaviours and lower for ethical behaviours (fig 1).

An interaction effect for parade suggested that other factors may also affect selection rates. Further analysis showed a significant relationship with listener ratings of voice similarity. This suggests that incorrect selection of voices in voice parades may be motivated by stereotyped judgements and/or by perceived similarity to the target voice, highlighting implications for voice parade procedures and the resulting evidence.

References:

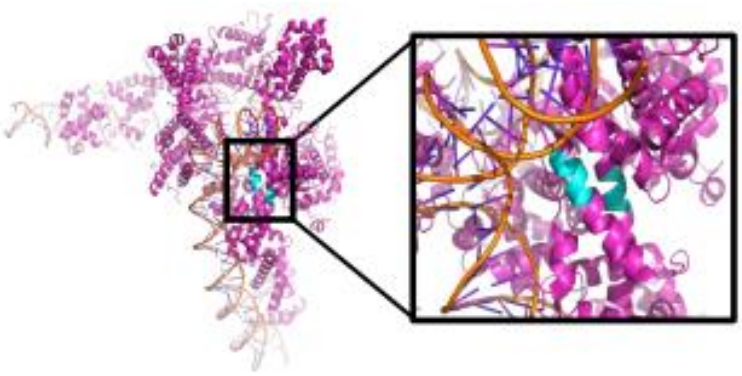
[1] Dixon, J. A., Mahoney, B. & Cocks, R. (2002). Accents of guilt? Effects of regional accent, race, and crime type on attributions of guilt. JLSP, 21(2).
[2] Paver, A., Wright, D., and Braber, N. (2021) 'Accent judgements for social traits and criminal behaviours: ratings and implications.' IAFPA 2021, Marburg.
[3] Pautz, N., McDougall, K., Mueller-Johnson, K., Nolan, F., Paver, A., and Smith, H.M.J. (2023a). Identifying unfamiliar voices: Examining the system variables of sample duration and parade size. QJEP.
[4] Pautz, N., McDougall, K., Mueller-Johnson, K., Nolan, F., Paver, A., and Smith, H.M.J. (2023b). 'Improving Voice Identification Procedures'. Strategic Research Themes Conferences, NTU 2023.

Developing a fragment library for de novo design of Affibodies by fragment-based geometric deep-learning

O. Wissett[1]*
* Corresponding author: ow5287@cam.ac.uk

[1] Centre for Misfolding Disease, Department of Chemistry, University of Cambridge, United Kingdom

***Keywords**: Affibody, Protein engineering, geometric deep learning, fragment learning*



Affibodies are a class of proteins derived from the B-domain of Staphylococcal protein A, also known as Z-domains [1]. Affibodies consist of 58 residues forming three α-helices and can bind a wide range of protein targets by varying 13 residues across helix-1 and helix-2 [1]. Currently, Affibodies are created through multiple rounds of in vitro screening of large combinatorial genetic libraries – this is slow, costly, and does not allow for targeting of specific epitopes [1]. We aim to create a method using geometric deep learning (GDL) to determine Affibody sequences predicted to bind to a given epitope, which may overcome these limitations. Supervised deep-learning requires many labelled data (>106 datum). Unfortunately, there exist fewer than 20 experimentally solved structures.

Here we present a general method for generating protein fragment libraries for GDL training. Protein fragments are small subsections of existing protein structures. Since the laws of physics are constant, fragments resembling Affibodies may be used to understand properties of Affibodies. This fact has previously been used to create novel antibodies by our lab [2]. To achieve this, we search through the structures of all solved protein structures for regions which are Affibody-like and then find their local interactome (the region inside the structure which is in contact with the matching region). Using this approach we have generated a large dataset of around ~500k fragments which is now being used to train models. This approach allows for the use of a highly specified dataset.

References:

[1] Ståhl, S., Gräslund, T., Eriksson Karlström, A., Frejd, F. Y., Nygren, P. Å., & Löfblom, J. (2017). Affibody Molecules in Biotechnological and Medical Applications. Trends in Biotechnology, 35(8), 691–712. https://doi.org/10.1016/j.tibtech.2017.04.007

[2] Aguilar Rangel, M., Bedwell, A., Costanzi, E., Taylor, R. J., Russo, R., Bernardes, G. J. L., Ricagno, S., Frydman, J., Vendruscolo, M., & Sormanni, P. (2022). Fragment-based computational design of antibodies targeting structured epitopes. Science Advances, 8(45). https://doi.org/10.1126/sciadv.abp9540

Alchemical Epistemologies of Extraction and Richard Eden's *Decaydes of the New Worlde*

Miraya McCoy[1]
*Corresponding author: mgm53@cam.ac.uk

[1] Faculty of English, University of Cambridge, United Kingdom

***Keywords**: extraction, colonialism, alchemy, early modern, Richard Eden*

This research looks at the way in which an alchemical hermeneutics was employed in early colonial systems of exploitation, taking the neglected text, Richard Eden's *The Decaydes of the New Worlde* [1555], as its primary source. It argues that early modern alchemical hermeneutics were in fact central to the imperialist epistemologies and discourses that drove praxes of extraction and domination.

The research demonstrates these ideas by revealing through close reading the ways in which Eden's cosmographical, colonial writings and translations are continuous with his work as an alchemist: the various praxes sharing an epistemological framework based around the creation and extraction of value. It unpacks the way in which the lexis of secrecy and searching within Eden's translation of Vannoccio Biringuccio's texts on metallurgy spreads itself throughout the volume, also taking root within the work on the discovery of the new world, thereby transferring extractive epistemologies from one discipline to the other. It builds upon Kathryn Yusoff's work on 'colonial grammars' and geology, as well as scholars such as Jennifer Morgan and Kim Hall on slavery and commodity systems.

In this way, the research evidences the ways in which the rich early modern field of alchemy was at the center of the period's thinking on surplus value, diligence, and discovery across disciplines, and how the deployment of an alchemical approach shaped and bolstered geographical practices that dehumanized indigenous subjects and turned the mineral world into a mine. My essay on this was awarded a mark of 77.

Keynote Speech 2

16:30-17:00

Frankopan Hall

On ‘Frontier AI’ and Racial Capitalism

Dr Jonnie Penn

Associate Teaching Professor of AI Ethics and Society
University of Cambridge

Coined in 1955, the term ‘AI’ has since been used to reference three entirely different schools of thought on how to manufacture cognition in non-biological material. By this view, the history of AI can be understood as a history of failure. Around these failures, however, the modern world has changed in ways that allowed new possibilities for the field: new data sources, sensors, labour norms, and expectations from surveillance and racialization. This talk connects milestones in ‘AI’ to longer histories of statecraft, the computer industry, the global finance industry, and empire. These complex histories provide rich evidence with which to calibrate speculation about AI and AI Ethics in the decades ahead.

Prize Giving Ceremony

17:00-17:30

Frankopan Hall

Drinks Reception

18:30-19:00

Master's Lodge

Conference Reunion Dinner

Tickets pre-purchased

19:00-21:00

Upper Hall