

# University of Barcelona - Downing College MCR, University of Cambridge Early Career Researchers' Day: Building Bridges!

## Oral presentations I

### **Impact of Straw Burning on Air Quality in China**

*Hongwei Xu - PhD in Applied Economics (University of Cambridge)*

With the gradual strengthening of efforts in air pollution control on a global scale, straw burning has once again attracted widespread attention as a significant pollution source. This study takes China as an example and fully utilizes medium-resolution remote sensing data provided by the Landsat-8 satellite, refining the research focus to the county level in China, comprehensively examining the overall impact of straw burning on air quality. Through the analysis of straw burning activities and air pollution conditions in 1,772 counties across China from 2015 to 2020, the research findings indicate that for each additional straw fire detected by satellite, the monthly average concentration of PM<sub>2.5</sub> in the corresponding county increases by 0.2212 ug/m<sup>3</sup>. Particularly, areas upwind of the county center are more significantly affected by straw fires. Among different pollutants, straw burning significantly increases PM<sub>10</sub> and PM<sub>2.5</sub> concentrations in the air. Moreover, the degree of impact is positively correlated with the credibility and area of the straw fires, with higher credibility and larger burned areas of straw fires having a more significant impact on air quality. This impact also exhibits pronounced seasonal differences, especially with more significant effects observed during autumn. These research results contribute to a more comprehensive understanding of the characteristics of straw burning's impact on air quality, providing reference for the formulation of agricultural development and environmental policies.

### **Sea surface temperature (SST) updating impacts on WRF model over Northwestern Mediterranean Sea**

*Eulàlia Busquets de Jover - PhD in Physics (Universitat de Barcelona)*

This study investigates the sea surface temperature (SST) updating effects on the Weather Research and Forecasting (WRF) model over the coastal regions of Northeastern Spain during July 2019. Two simulations were conducted: the first without updating SST and the second updating it. Specifically, the study focused on two distinct periods of July 2019: days 8-10, characterized by storms over the Pyrenees, and days 24-26, characterized by a heatwave. The objectives of this study are 1) to assess the SST updating impacts on WRF model, particularly on surface and planetary boundary layer (PBL) parametrizations, and 2) to explore the differential behavior of the WRF model between storm and heatwave situations.

SST affects surface parameterization through surface fluxes, with the latent heat flux being more sensitive than the sensible heat flux to SST variations. These fluxes impacted the stability regimes. On days 8-10 the system tends towards neutrality when updating SST, hence is



dominated by wind shear turbulence, whereas on days 24-26, the SST updating leads to very unstable conditions, dominated by buoyancy.

The spatially averaged potential temperature vertical profiles at 00:00 reveal greater variability during storm conditions, especially at higher levels. Furthermore, between days 24-26, the averaged potential temperature profile displayed the maximum differences between the updated and non-updated simulations at the surface, with differences decreasing with increasing height. Conversely, during days 8-10, differences between profiles increased until approximately 90m.

These findings show the significance of SST updating during July 2019. Specifically, during the period of July 8-10, SST updating demonstrates a more pronounced impact on meteorological variables, particularly on-air potential temperature, compared to the period from July 24 to 26. However, these results are specific to July 2019 over the Northwestern Mediterranean Sea, and further investigation is needed to assess their applicability in different periods with similar meteorological conditions.

### **Evolution of Toxin Resistance in the Grasshopper Mouse**

*Claudia Perez-Calles - PhD in Bioinformatics (University of Cambridge)*

Novel traits enable many rodents to thrive in extreme environmental niches. For example, predatory grasshopper mice have co-evolved resistance to painful and lethal neurotoxins produced by their scorpion prey. Interestingly, toxin resistance in the three species of grasshopper mice (*Onychomys torridus*, *Onychomys leucogaster*, *Onychomys arenicola*) varies; *Onychomys torridus* exhibits the highest resistance and *Onychomys leucogaster* the least. Grasshopper mice also feed on pinacate beetles, whose toxic sprays irritate the eyes and nasal tissues of predators.

Our goal is to use a comparative genomics framework to understand the relationship between toxin resistance and karyotype evolution in grasshopper mice. Using long reads to create reference genomes for the three *Onychomys* species and the closest outgroup, *Peromyscus eremicus*, we are currently identifying loci that have undergone species-specific changes of evolutionary constraint in coding genes, non-coding genes, and regulatory elements contributing to toxin resistance. Our focus is on gene families related to pain and olfaction. In parallel, we are characterizing the molecular response to toxin exposure by analyzing differential gene expression (RNA-seq before and after toxin exposure) in pain-signalling tissues.

Initial results reveal that a mutation in *Onychomys torridus* NaV1.8 shown to contribute to pain resistance is also present in *Peromyscus eremicus*. While *Peromyscus eremicus* shares the same habitat as bark scorpions, they are not known to prey on the scorpions or to be resistant to the venom. These results suggest that *Peromyscus eremicus* have evolved some pain resistance mutations. Alternatively, additional mechanisms may contribute to toxin pain resistance.

### **Dialogic process in masculinity development in public spaces**

*Gerard Quílez Relaño - PhD in Social and Organizational Psychology (Universitat de Barcelona)*

In the last few decades, multiple processes of urban transformation have changed metropolises around the world. Barcelona, a self-proclaimed beacon of multiculturalism, has been reconfigured based on recent phenomenon (touristification, gentrification, the transition from an industrial to a third-sector city, etc.). Although these phenomena have been amply studied, little has been said about gender construction in public spaces. One of the main takeaways found in more recent studies is the so-called "new gender expressions" of the "new middle classes", a poorly developed concept (underdeveloped?) that collided with our perspective of gender and capitalist movements. In light of this significant gap in the literature, we conducted a first study



on hegemonic and non-hegemonic gender roles in gentrified public spaces in the neighbourhoods of Gracia and Poblenou.

Using mixed methods (the semiotic discourse analysis and the descriptive statistics of traditional gender roles of 1.563 neighbourhood businesses) this study concluded that, despite these “new gender expressions”, the gender expressions present in both neighbourhoods were deeply binary and patriarchal. Following this discovery, we designed a plan to study how gender is constructed in neighbourhoods that have been less affected by the new processes of urban transformation, aiming to mitigate the potential interference of gentrification or touristification in gender performativity. To this end, we will conduct the study in the neighbourhoods of Bon Pastor, la Sagrera and Sant Antoni.

Consequently, we divided the research in three main phases:

- (i) A PRISMA systematic review of the literature on the topic to develop the analytic keys and gender dimensions of public space.
- (ii) The mapping of the three neighbourhoods based on those dimensions.
- (iii) The use of moving interviews of men related to the three neighbourhoods and the subsequent analysis of the discourse, cartography and cognitive maps elaborated.

## Oral presentations II

### **Corporate 'Human' Rights: Challenging the Legitimacy of Human Rights Law**

*Nina Prusac - PhD in Law (Human Rights Law) (University of Cambridge)*

Recent decisions by some of the highest international and national Courts have showcased a tendency to grant corporations, entities existing only in law, human rights on the same basis as natural persons. It is widely understood that the human rights framework exists in order to protect human beings and their unique vulnerability and dignity. However, the trend of corporate appropriation of human rights protection and discourse has been increasing in scope and number, while remaining unresearched. A closer look into the evolution of corporate 'human' rights reveals insights into the capitalist foundation of human rights law. The understanding of this foundation, in turn, highlights important consequences regarding the purpose of human rights and their protective nature. Can human rights be considered protectors of humans if they are (mis)used by artificial entities in ways that actively harm the individual.

### **Application of Nanomedicine in neurodegenerative diseases**

*Gerard Esteruelas Navarro - PhD in Drug Research, Development and Control (Universitat de Barcelona)*

Nowadays, due to numerous factors, neurodegenerative diseases have become one of the biggest health problems worldwide. Within the complex and heterogeneous group of these diseases, which are characterized by a progressive deterioration of various areas of the nervous system, resulting irreversible neuronal loss, include pathologies as diverse as Amyotrophic Lateral Sclerosis, Alzheimer's disease, and even neuronal loss following Spinal Cord Injury. Due to their severity, high incidence, and the absence of effective treatments, these diseases represent a significant challenge for medicine. The use of nanotechnology for these diseases offers numerous advantages in both diagnosis and treatment. Therefore, we have developed a new biocompatible multi-target nanotechnology platform that encapsulates Riluzole for the treatment of these diseases. We have conducted physicochemical analyses for the correct characterization of these nanoparticles, as well as in vitro and in vivo studies of biodistribution, toxicity, and therapeutic efficacy using Induced Pluripotent Stem Cells (iPSC) technology and pathophysiological mouse models among others.



### **Global Museums, Local Stories: Satellite museums amidst new cultural cartographies**

*Alejandra Linares Figueruelo - PhD in Society and Culture: History, Anthropology, Art and Heritage (Universitat de Barcelona)*

This research explores the operational, cultural, and socioeconomic dimensions of satellite museums, extensions of parent institutions into new territories, like the Guggenheim Bilbao and Louvre Abu Dhabi, by focusing on their roles in global and local contexts. Utilising a mixed-methods approach, including museum ethnography and geospatial analysis, this research; anchored on Mary-Louise Pratt's 'Contact Zones' (1991), analyses their role in cultural exchange amidst neo-colonial legacies and north-south, centre-periphery dynamics. It examines their evolving functions in diverse geopolitical contexts, revealing how they balance cultural representation, economic objectives, and the pursuit of intercultural dialogues. This study situates satellite museums within broader debates about their role as agents of soft power (Nye 1990) and explores their critical impact on regional development (Landry 1995, Bourdieu 1986), as well as in the contemporary international relations landscape (Castells 1996, Latour 1986). The central hypothesis posits that satellite museums emerge from a blend of cultural, economic, urban, and political influences. Initially driven by economic considerations, these museums have developed to reflect historical national and social influences, and contemporary global economic, cultural, and diplomatic trends, creating a complex interplay between these forces. This duality frequently leads to conflicts similar to those experienced by other museums within the neoliberal paradigm, where cultural institutions wield significant influence in the global cultural economy. Key findings reveal that successful satellite museums effectively integrate into local contexts fostering intercultural dialogue and supporting regional development. However, the study also identifies persistent issues such as the reinforcement of cultural hierarchies and the socio-economic impacts of gentrification. By critically analysing both the beneficial and problematic aspects of satellite museums, this research contributes to a nuanced understanding of their role in contemporary museology and international cultural relations. The research outcomes offer practical recommendations for museum professionals and policymakers, emphasising the importance of ethical engagement and sustainable practices.

### **Fighting Global Warming with Whiter Clouds**

*William Smith - PhD in Climate Science (University of Cambridge)*

Anthropogenic climate change poses an existential threat to humans and wildlife. Reducing greenhouse gas emissions and land use are the only way to solve the problem. However, it is likely that this alone may not stop some of the worst impacts of climate change. This gives rise to the idea of Solar Geoengineering, a near-science-fiction idea that we could cool the planet by reflecting sunlight on a global scale. This talk will focus on one particular method of Geoengineering known as Marine Cloud Brightening, whereby the micro-physics of cloud are exploited to make them whiter and therefore reflect more sunlight. We will look at potential benefits and negative consequences of this technique and look at the past and into the future of the field to consider if it is a viable solution to climate change.

## **Oral presentations III**

### **Nanopore Sensing for RNA Structural Modifications**

*Siong Chen Meng - MPhil in Biophysics (University of Cambridge)*

RNA modifications are extremely prevalent and diverse, with over 170 types having been found, ranging from methylation like in 5-methylcytosine (m5c) to inosine involved in wobble base



pairs. These modifications have proven to be essential for the regulation of RNA processing, such as splicing. Furthermore, misregulation resulting from over or under modification has been linked to cancer. Although significant efforts have been made into mapping the epitranscriptome, limitations inherent to methods, such as enzymatic bias in NGS, have made an accurate picture of these chemical modifications difficult. Using nanopore sensing and DNA/RNA nanoswitches, we intend to detect and quantify RNA modifications in vitro. The nanoswitch changes its state from “open” to “closed” when a DNA strand hybridises with our RNA carrier. This creates a loop in the carrier strand and results in an easily recognisable peak in the current trace. By making the hybridisation competitive with another oligomer on the carrier and taking advantage of the subtle differences in the binding efficiency of modified versus unmodified bases, we are able to detect methylation on our DNA strand. We are looking to extend this strategy to RNA, providing a means to detect and quantify RNA modifications on a single molecule level, all without chemical or enzymatic methods.

### **Has the Covid-19 Pandemic Crisis acted as a mitigating effect on the relationship between Integrated Reporting Quality (IRQ) and the Cost of Debt of Companies (Kd)?**

*Elena Jordà Santana - PhD in Business (Universitat de Barcelona)*

The purpose of this research is to analyse through an empirical study whether the Covid-19 pandemic crisis has had a mitigating effect on the relationship between Integrate Reporting Quality (IRQ) and the cost of debt (Kd). Data will be collected from 127 European companies that adopted the voluntary IR from 2017 to 2022. To test the research hypothesis, a linear regression model would be estimated. This work will contribute to the scientific literature by offering an empirical study relating to the Covid- 19 pandemic effects on the IRQ and Kd relationship. In addition, it will be useful for managers and policymakers to consider the IR to include the Sustainable Development Goals (SDGs) impacts of the United Nations Agenda 2030 in the organizations strategy and, on the other hand, to assist them in the process of the new rules of Non-Financial Reports (NFR). In UE, this study will help the stakeholders implicated in the implementation of the Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament as regards Sustainability Reporting Standards (SRS).

### **A green bright future. CRISPR-Cas9 and GFP in the study of *Oikopleura dioica***

*Constantino Andrés Molina - PhD in Genetics (Universitat de Barcelona)*

*Oikopleura dioica* is a zooplanktonic chordate that has undergone massive gene loss during its evolution and is a novel animal model in the field of EcoEvoDevo. It is a small sized species with a rapid life cycle, deterministic development, abundant offspring and easy maintenance. These characteristics together with the gene losses it has experienced, including genes critical for embryonic development, offer a unique and ideal system for studying developmental evolution within our own phylum. Molecular information and tools that allow gene editing of the model are a key aspect for this type of study. At the genomic level, we currently have databases with sequences from worldwide populations of *O. dioica* (Barcelona, Bergen, Okinawa and Osaka). Recently, different resources with highly valuable transcriptomic information have also been generated. At the gene manipulation level, microinjection techniques have been developed in our laboratory to generate knockdowns using RNAi, DNAi and CRISPR-Cas9. The maintenance of these mutant lines, however, requires intensive continuous genotyping, as the parental generation dies promptly after spawning. The aim of my thesis project will be to further develop the CRISPR system for the generation of knockins through insertion of fluorescent reporter genes. These reporter genes will simplify the selection of modified animals and allow the generation of mutant animal lines, specific cell lineage tracking and biosensors. These new resources will be applied to the study

of heart and muscle developmental mechanisms, and the response of the embryo to environmental stress, which are the main active lines of research in our laboratory.

### **Governing Sacrifice in the ‘Chilean Chernobyl’: The Power and Politics of Extraction in Quintero-Puchuncaví, Chile**

*Sophie Parish - MPhil in Development Studies (University of Cambridge)*

Resource extraction has been a key driver of industrial development since the beginning of the colonial period five hundred years ago. Today, extractivist policies continue to permeate the Latin American political landscape and are advanced by governments as an important driver of socio-economic development. Such policies, however, have led to environmental and social devastation in regions rich in natural resources, whose natural environment and local population are ‘sacrificed’ in favour of economic development. In these ‘sacrifice zones’, local populations live alongside massive industrial complexes at great cost to their personal health and well-being. This research focuses on Chile’s most famous sacrifice zone, Quintero-Puchuncaví. Nicknamed the ‘Chilean Chernobyl’, this region is home to the Ventanas Industrial Complex where national and international companies extract oil, copper, and hydrocarbons. Through semi-formal interviews and participatory observation, this research explores the social, environmental and health impacts of this industrial complex on the local population in Quintero-Puchuncaví. The data collected shows a clear link between extractive models of development in Chile and the socio-environmental degradation of Quintero-Puchuncaví. It also highlights the impact of local territorial resistance in promoting change at a national level and hints at the fundamental challenges of moving towards the green transition and a post extractive world. Finally, the patterns of resource extraction and its consequences in Quintero-Puchuncaví point to a larger underlying problem that is our relationship to the natural world, which is commonly regarded as valuable only insofar as it can provide capital accumulation.

## Posters

P01

### **The Human Rights Aspects of Corporal Punishment: Realizing Children’s Overdue Entitlement to Equal Protection from Assault**

*Rick Aiyer – Master of Law (University of Cambridge)*

Only 14% of the world’s children are fully protected in law from all corporal punishment. Since Sweden pioneered abolition over forty years ago, in 1979, merely 62 states have followed suit. The presentation will provide a brief overview of the human rights aspects of corporal punishment. In particular, it will discuss children’s entitlement to equal protection from assault under the UN Convention on the Rights of the Child. It will also discuss children’s entitlement to equal protection from assault as a derivative of the right to dignity and equality. It will then explore the divergence between theory and practice as well as the scope for judicial intervention, drawing on the Israeli decision in *Plonit* (which abolished the defence of “reasonable correction”) and the Canadian decision in *Canadian Foundation* (which upheld a similar defence in Canadian criminal law). By way of conclusion, the presentation will challenge the assertion that abolishing protection for corporal punishment risks exposing parents and caregivers to state enforcement for light “pats on the bum”.



P02

**Theatre in Times of Transition: The Value of Studying Theatre in Understanding the Spanish Transition**

*Martí Alós López - PhD in Society and Culture: History, Anthropology, Art and Heritage (Universitat de Barcelona)*

This exposition aims to demonstrate the benefits that theatre can bring in providing a complete approach to the historical processes. Particularly in contexts of high dynamism, theatre emerges as an artistic discipline that bonds with its audience, and can reveal the political, social, cultural, or mental changes in its dynamic. In this case, we will describe the main elements of Catalan theatre during the Spanish Transition to democracy as a historical phenomenon. We will begin with an approach to the Spanish Transition studies and the trends observed in Catalan theatre during the sixties and seventies in order to understand the first assembly-based and self-manages experiences following the death of General Franco. Subsequently, we will analyse the main trajectories followed by the theatre scene as it progressed to build a democratic industry. At the same time, we will try to identify some of the connections with political and associative movements (such as neighbourhood associations, feminists, and political parties like PSUC), highlighting the value and interconnexion between theatre and its immediate context. Our goal is not to chase exhaustiveness, but to point certain elements that can contribute to show the explanatory significance that theatre can bring to the historical knowledge. Specially in a phenomenon that needs to be reconsidered, as it is the origin of the political, electoral, constitutional, social, and institutional system (including cultural institutions) that has persisted until today. We need to comprehend our past, in order to reassess and confront the challenges of our present.

P03

**Collagen Scaffolds as a Substrate for Lung Tissue Engineering**

*Vivien Alves Passing - PhD in Materials Science (University of Cambridge)*

Understanding lung stem cell biology is key to creating accurate cell models and developing new therapies. Lung organoids are a useful research tool, but current 3D models and culture systems, including Matrigel, lack the spatial, biomechanical and biochemical cues required to promote and maintain cell phenotype and viability. Ice-templated collagen scaffolds are 3D sponge-like structures, which can be tailored to provide an architecture that is very similar to the native lung structure. Here, we will discuss how the scaffolds are produced and modified to mimic lung tissue. The effect of changing various parameters during scaffold production on the lung cell response will then be evaluated. Finally, we will discuss the implications this has on the advancement of cell models and lung tissue engineering.

P04

**A green bright future. CRISPR-Cas9 and GFP in the study of *Oikopleura dioica***

*Constantino Andrés Molina - PhD in Genetics (Universitat de Barcelona)*

*See abstract: Oral presentations III*

P05

**Idealised Modelling for Ocean Carbon Dioxide Removal**

*Elisavet Baltas - PhD in Oceanography (University of Cambridge)*

Effective and large-scale atmospheric carbon capture is essential in limiting global warming to within 1.5 degrees Celsius as outlined by the Paris Agreement. The ocean makes up over 70% of

the Earth's surface, has already absorbed approximately 40% of fossil fuel burning emissions and stores 50 times more carbon dioxide than the atmosphere. Therefore, it is imperative to maximise its carbon sequestration ability through large scale Carbon Dioxide Removal (CDR). One technique that aims to improve the efficiency of oceanic carbon uptake is Marine Biomass Regeneration (MBR). MBR is grounded on evidence that introducing certain key nutrients to nutrient depleted areas of the ocean can enhance primary productivity and regenerate ocean biomass, which then acts as a carbon sink.

Two idealised models for ocean carbon and heat uptake are extended to include biological processes and nutrient cycling. These models have previously been used to carry out climate projections, by investigating the effect of ocean ventilation on the surface warming response to annual anthropogenic emissions but have only accounted for physical and chemical transfers. Using the extended models with biology, it will be possible to undertake MBR simulations with different nutrient concentrations and investigate the impact these parameters have on the oceanic carbon uptake and distribution from anthropogenic carbon emissions.

P06

#### **The Universe on a USB stick**

*Toni Bertólez - PhD in Physics (Universitat de Barcelona)*

As of today, no particle physics experiment has measured yet the absolute mass of neutrinos, and experimental bounds are still far away from the minimum masses allowed by neutrino oscillations. However, the latest cosmological observatories have set the best upper bounds and the neutrino bounds. Even more, a detection is currently promised by experiments such as EUCLID, which is already taking data. In this talk, I will explain how do these measurements work and convey. In fact, I will show that all these results are model dependent and are relaxed if new physics in the neutrino sector exists. Finally, I will briefly present a framework to disentangle the different effects on neutrino masses on cosmology in a model independent manner.

P07

#### **Development of novel non-peptidic VHL binders using a fragment-based approach**

*Patricia Blanco Gabella - PhD in Biomedicine (Universitat de Barcelona)*

Targeted Protein Degradation has emerged in recent years as a revolutionary strategy in drug discovery. The von Hippel–Lindau protein (VHL) is a well- validated E3 ligase that is recruited by many efficacious PROteolysis TArgeting Chimera molecules (PROTACs). However, all existing VHL warheads have been developed around a central hydroxyproline unit and, owing to their peptidic nature, exploiting them pharmacologically is challenging due to their poor absorption, distribution, and metabolism. Consequently, few VHL PROTACs have reached clinical stages so far.

Here, we apply a fragment-based approach combining computational techniques and ligand-observed NMR studies to discover new chemotypes for VHL ligands that could be developed into more effective drugs. A virtual screening of all the accessible fragment space followed by paramagnetic relaxation enhancement assays allowed us to identify two novel fragment hits for the hydroxyproline binding site. These fragments show a stronger response for VHL than the L-hydroxyproline core on its own. Subsequently, we performed  $\mu$ s-long molecular dynamics simulations of VHL and multiple copies of each ligand to refine the predicted poses of the fragment hits. Finally, these compounds will be used as a starting point for fragment-growing strategies to obtain more potent ligands.



P08

**Sea surface temperature (SST) updating impacts on WRF model over Northwestern Mediterranean Sea***Eulàlia Busquets de Jover - PhD in Physics (Universitat de Barcelona)**See abstract: Oral presentations I*

P09

**Organic Phototransistors for Near-Infrared Light Detection***Lluís Casabona Cendra - PhD in Physics (Universitat de Barcelona)*

Near-infrared (NIR) light detection is pivotal in modern science and technology, such as in health monitoring, optical communications, and spectroscopy, among others. Current NIR photodetectors predominantly rely on photodiodes based on inorganic semiconductors. These devices exhibit good performances alongside some drawbacks, such as high brittleness and a complex manufacturing process. In the last decades, solution-processed NIR-sensitive organic semiconductors (OSCs), which can be highly conjugated small organic molecules or polymers, have emerged as attractive alternatives, due mainly to their low cost processability, tailorable optoelectronic properties, and compatibility with flexible substrates. Devices based on OSCs that can convert light into electrical signals are commonly referred to as organic photodetectors (OPDs). OPDs can be classified as photoconductors, photodiodes, and phototransistors. Organic phototransistors, often constructed using organic field-effect transistors (OFETs), are illustrated schematically in Fig. 1a. One of the challenges for NIR OPDs is to develop organic photoactive materials with ultra-narrow bandgaps. One promising candidate to address this issue is Y6, a non-fullerene acceptor (NFA) depicted in Fig. 1b. This organic material was first developed by Zou and co-workers and has shown interesting optoelectronic properties such as high charge mobility for an OSC and an absorption band centered at 841 nm (Fig. 1c). However, research focusing on the use of pristine Y6 in OFETs and the photoresponse of these devices remains notably limited up to the present. In this work, we investigate the crystallinity of Y6 thin films and evaluate the optoelectronic response of Y6 OPDs under NIR illumination. Our aim is to study the potential of Y6 as a prospective candidate for NIR OPDs, with potential applications in health monitoring.

P10

**Application of Nanomedicine in neurodegenerative diseases***Gerard Esteruelas Navarro - PhD in Drug Research, Development and Control (Universitat de Barcelona)**See abstract: Oral presentations II*

P11

**Has the Covid-19 Pandemic Crisis acted as a mitigating effect on the relationship between Integrated Reporting Quality (IRQ) and the Cost of Debt of Companies (Kd)?***Elena Jordà Santana - PhD in Business (Universitat de Barcelona)**See abstract: Oral presentations III*

P12

**Thermoacoustic response of non-swirling and swirling lean premixed flames***Dimitrios Kallifronas - Postdoc in Engineering*

Thermoacoustic instabilities pose a major problem in gas turbine development. To determine frequencies at which those instabilities are encountered, it is crucial to understand how flames respond to acoustic excitation. Swirling flames are very common in modern combustors as they



offer benefits in terms of flame stabilisation and reactant mixing. However, flame dynamics can be substantially different to non-swirling flames. In this work, the differences in the flame response of swirling and non-swirling flames are explored in the framework of flame describing functions which links acoustic perturbations and heat release oscillations. This is achieved through a series of high-fidelity computer simulations.

P13

### **Understanding the Mechanism of Trichome Development in *Hibiscus Trionum***

*Min Kim - PhD in Biological Sciences (BBSRC DTP) (University of Cambridge)*

Trichomes are specialized hairs, which contribute to intricate patterning of the plant epidermis. They exhibit diversity in terms of morphology and patterning, playing crucial roles in pollinator attraction as well as structural defense against herbivores. Despite their diversity and importance, the mechanism underpinning trichome formation remains poorly understood. Our studies aim to lay groundwork for evo-devo trichome studies, by characterizing the morphological diversity and patterning of trichomes in petal and nectaries in *Hibiscus trionum* (*H. trionum*) and starting to investigate the genetic bases of trichome specification and morphogenesis. I identified seven distinct trichome types varying in morphology emerge in a spatially coordinated manner on developing *H. trionum* petals. Trichomes are also present between petals and sepals where they form composite nectaries: glandular trichomes at the base of the petal-sepal junction form nectary glands. The glands are bordered by elongated trichomes with a possible defensive role. Thus, developmental boundaries must be specified at early developmental stages to generate the zonation and form a complete functional nectary. I also found that candidate nectary development genes were expressed in a gradient across the nectaries, with higher expression at the base of the nectary (where glandular trichomes will emerge) than in the bordering region where elongate non-glandular trichomes form, indicating possible dosage-dependent expression of genes creating boundary fates and specifying distinct trichome identities. Additionally, I characterized trichome distribution in *Hibiscus richardsonii*, the sister-species of *H. trionum*, to start understanding the processes underpinning trichome evolution. Trichome morphology and patterning was distinctive in *H. richardsonii* with more clavate trichomes in the petal proximal region, as well as stellated trichomes at the nectary bordering region. Altogether, these findings suggest *Hibiscus* as an ideal model to study the mechanism of trichome development.

P14

### **Regulatory Roles of Cell-Cell Adhesions in Primitive Endoderm Specification**

*Chen Yen Leow - MPhil in Biological Sciences (University of Cambridge)*

The early stages of mouse embryonic development see the transition of a fertilised egg, or zygote, into a blastocyst. During this transition, the zygote undergoes multiple rounds of cell division, establishing 3 major cell lineages in the process: primitive endoderm (PrE), epiblast (Epi) and trophoblast. In the early blastocyst, the PrE and Epi have not been sorted and are indistinguishable from each other. At this stage, they are collectively referred to as the inner cell mass (ICM). As the blastocyst continues along the development trajectory, the ICM sorts into two distinct layers, PrE and Epi. Considerable research has been done to elucidate the mechanisms that drive the sorting process of the ICM into PrE and Epi, though the associated signalling pathways remain unclear.

Plakoglobin, a homolog of  $\beta$ -catenin, has been shown by single cell-RNA sequencing as well as confocal imaging of late blastocysts, to be strongly down-regulated in the PrE. Though conventionally known as a desmosomal protein, Plakoglobin can also replace  $\beta$ -catenin to bind at adherens junctions. This research aims to study the role of cell-cell adhesions, specifically the

role of plakoglobin, in PrE and Epi specification. In particular, we aim to elucidate how plakoglobin might influence differentiation efficiency and the formation of cell-cell junctions through comparison of wild-type, plakoglobin-overexpressing and plakoglobin-knockout cell lines.

P15

**Global Museums, Local Stories: Satellite museums amidst new cultural cartographies**

*Alejandra Linares Figueruelo - PhD in Society and Culture: History, Anthropology, Art and Heritage (Universitat de Barcelona)*

*See abstracts: Oral presentations II*

P16

**Identification and Validation of New In-silico Designed MYC binders For the Design of PROTACs**

*Wenzheng Neng - PhD in Pharmacology (University of Cambridge)*

The transcription factor MYC is involved in the regulation of 2/3 of the human genome. MYC deregulation is considered the hallmark of most types of cancers<sup>1</sup>, making it a key target for therapeutics. MYC is highly disordered making it challenging to target, and no small molecule has passed clinical in the past two decades. The aim of this work is to identify and validate potential MYC binders or inhibitors as the warhead of PROteolysis TARgeting Chimeras (PROTACs) using the approach of computer-aided drug discovery consisting of ligand-based virtual screening (SBVS) and ligand-based virtual screening (LBVS).

P17

**Integrating Renewables in the Sri Lankan Energy System – A Leapfrogging Approach**

*Jivanka Kavishan Pathirage - MPhil in Engineering for Sustainable Development (University of Cambridge)*

Sri Lanka is currently categorized as a Lower middle-income country. Sri Lanka was a country that had almost 8-hour power cuts daily not long ago. Sri Lanka wants to increase its Renewable share of the energy system replacing fossil fuel. Fossil fuels are both polluting and expensive. Sri Lanka does not produce fossil fuels. Therefore, the country needs to import them which has a considerable effect on the foreign currency reserves of the country. Sri Lanka's renewable trajectory has a focus on Solar and Wind power. The country has planned to construct numerous wind parks, solar parks, and energy parks around the country. This will aid in achieving Sustainability targets for the country. I want to research on what are the technologies related to Solar and Wind that Sri Lanka is currently missing. This I believe would be the 'Leap Frogging' aspect of the study. For example, whether we can use much higher power-generating wind turbines would result in producing more energy in each area. Then the next problem occurs. Power generated through Solar, and wind is not stable. They are temporal generation. Therefore, the excess energy needs to be stored. But the dilemma is that energy storage is expensive, and Sri Lanka is not a rich country! The energy storage Sri Lanka currently uses is Hydro Storage (1400 MW approx.) through projects like "Victoria", "Upper Kotmale" etc. I want to research what are other potential ways energy can be stored such as pumped storage (which is used UK) and battery technologies. I want to see what the advantages and disadvantages of such technologies are. What can be the enablers of these technologies. I believe the new technology that I can suggest would be considered a leap-frogging approach as the current trajectory is not focusing on them. As the supply and storage have now been covered, the demand should be tackled as well. Sri Lanka does have a scheme to charge the commercial sector based on the time they use electricity and energy. Such pricing has not been successfully

implemented for domestic consumers. This was due to the high cost of such meters to be installed in households at the time when it was implemented for industries. I want to research whether smart meters and other demand-side strategies are feasible to be implemented in Sri Lanka in the current and foreseeable context. Then the barriers and opportunities of these technologies are to be evaluated.

P18

**Dialogic process in masculinity development in public spaces**

*Gerard Quílez Relaño - PhD in Social and Organizational Psychology (Universitat de Barcelona)*

*See abstract: Oral presentations I*

P19

**Discovering the amyloid antiaggregating potential of new dual sEH-AChE inhibitors for the treatment of Alzheimer's disease**

*Anna Sampietro Pifarre - PhD in Organic Chemistry (Universitat de Barcelona)*

Alzheimer's disease (AD), the leading cause of dementia, involves complex mechanisms like neuroinflammation, cholinergic deficit, and protein aggregation. Our strategy targets these areas by: 1) inhibiting soluble epoxide hydrolase (sEH) to increase anti-inflammatory epoxyeicosatrienoic acids (EETs); 2) inhibiting acetylcholinesterase (AChE) to boost acetylcholine levels; and 3) preventing amyloid protein aggregation. We developed novel inhibitors targeting both sEH and AChE with amyloid anti-aggregating properties. These hybrid compounds, created by linking sEH and AChE inhibitor pharmacophores, show enhanced potency with subnanomolar or single-digit nanomolar IC<sub>50</sub> values. They significantly inhibit beta-amyloid and tau aggregation (over 50% at 10  $\mu$ M), and some also inhibit TDP-43 aggregation. Most compounds are non-neurotoxic at 100  $\mu$ M, cross the blood-brain barrier, and have moderate solubility and microsomal stability. Ongoing studies include pharmacokinetic evaluations and efficacy tests in an AD mouse model to assess their potential as disease-modifying drugs.

P20

**3D Porous Electrodes in Living Biophotoelectrochemical Systems: Insights for Optimal Electrode Design**

*Linying Shang - PhD in Chemistry (University of Cambridge)*

Interfacing photosynthetic microorganisms with 3D electrodes, a platform designed to harness solar energy for power generation and fuel production sustainably, bridges the natural and artificial worlds. Enhancing the performance of such systems hinges on improving the abiotic component—the electrode.

State-of-the-art electrodes in this field are micro-pillar and inverse opal (IO) electrodes fabricated from indium-tin-oxide (ITO) nanoparticles.<sup>2</sup> Here, we provide important lessons for electrode design by varying the geometries of 3D electrodes, characterising their dimensions, light management ability, surface morphology, electroactive surface area, cells wiring efficiency, and relating these to their biophotoelectrochemical performance. Our results indicate that the larger pore-sized IO-ITO enabled increased light accessibility to their surface area for the microorganisms and gave rise to the highest photocurrent output. Additionally, pillar electrodes, rapidly prototyped through 3D printing and capable of being studied in a broader parameter space, provided valuable insights into optimal 3D electrode design for biophotoelectrochemical applications. The lessons drawn from both structures mutually inform and guide future electrode design, emphasising the importance of leveraging light, biocatalysts, and 3D structures effectively.

P21

**Synthesis of bioactive nitrogen-containing compounds via metal-catalyzed asymmetric hydrogenation***Martí Sidro Inglés - PhD in Organic Chemistry (Universitat de Barcelona)*

The present doctoral thesis focuses on the efficient and sustainable preparation of chiral drugs, more specifically on the synthesis of chiral amines. Around 40-45% of the drugs on the market contain a chiral amine in their structure. Therefore, the efficient synthesis of this type of compound is of vital importance. An ideal methodology for the synthesis of chiral amines is asymmetric hydrogenation. The host laboratory located at IRB Barcelona has extensive experience in the development of iridium catalysts for this transformation. More specifically, the thesis focuses on the hydrogenation of 3,3-diarylallyl amines, a difficult substrate that poses a significant challenge in the field of asymmetric hydrogenation. The resulting chiral 3,3-diarylpropanamines are important pharmacophores present in various drugs. In the second phase of the thesis, the synthesis of quinoline based P-stereogenic ligands will be studied. Due to their structural similarity to the original Crabtree catalyst, great potential for this new type of catalyst in the asymmetric hydrogenation of alkenes can be foreseen. The efficacy of these new catalysts in hydrogenation will be also studied.

P22

**Lost and Found: Navigating Ambiguity in Bilingualism***Chara Triantafyllidou - PhD in Theoretical and Applied Linguistics (University of Cambridge)*

Bilingual children who speak English as an Additional Language (EAL) comprise about 20% of the pupil population in the UK., EAL pupils consistently demonstrate lower language attainment and reading skills compared to their monolingual counterparts, with the underlying causes of this performance gap remaining unclear.

This research delves into the reading abilities of Year 5 EAL pupils (aged 9 to 10) through an eye-tracking experiment designed to explore their ability in resolving temporary ambiguity, with a focus on the prosodic syntactic effect of commas. The study contrasts the performance of EAL pupils with that of their monolingual peers, considering various linguistic factors including vocabulary, prosody, and grammar, alongside ecological factors such as socioeconomic status and reading habits, to comprehensively understand their influence on reading comprehension. Preliminary findings show a disparity in syntactic disambiguation abilities between EAL pupils and their monolingual counterparts, despite comparable levels of reading comprehension as assessed by the widely used YARC standardised assessment.

P23

**Non-breeding carry-over effects on the breeding performance of three long-lived migratory seabirds***Diego Vicente-Sastre - PhD in Biodiversity (Universitat de Barcelona)*

Migration and reproduction are two crucial processes in the annual cycle of any migratory species since both involve high energy investments. In long-lived species, both processes often interact with each other, i.e., what happens in one stage can affect the next. This phenomenon is known as carry-over effects. We evaluated here the relationship between migratory phenology and breeding success in three *Calonectris* shearwaters that breed in islands and islets across the Mediterranean and Macaronesian water masses, and that overlap in their wintering areas during the non-breeding period. We recorded information on the migratory trips and demography of 367 individuals tracked repeatedly with light-level geolocators. In total, we determined the departure and arrival dates to the colony and to the wintering areas of 1.486



migratory trips (71%, 16%, 13% for *C. borealis*, *C. edwardsii*, and *C. diomedea* respectively). Also, we determined environmental variables of the wintering areas (primary productivity, sea surface temperature, heatwaves, bathymetry) that could affect to the subsequent breeding success. Using generalized linear mixed models, we found that previous breeding success was not influenced by the timing of migration. Wintering areas were consistent over time and environmental variables did not influence on the phenology of the individuals significantly. Nevertheless, we found that males arrived earlier to the colony and earlier breeders, those that leave later the wintering areas and arrive earlier to the colony, showed larger probability of successful breeding. Therefore, our results add robust evidence on how inter-seasonal, carry-over effects can impact the demography of long-lived species.

P24

### **Molecular Characterization Unveiling Inositol 1,4,5-triphosphate (IP3) Binding Effect Determined by the IP3 Receptor N-terminal Domain**

*Yu Zhu - PhD in Pharmacology (University of Cambridge)*

The inositol 1,4,5-triphosphate receptor (IP3R) is integral to cellular calcium signalling, modulated by the binding of inositol 1,4,5-trisphosphate (IP3) to its N-terminal domain which triggers the allosteric opening of a distant Ca<sup>2+</sup>-conducting pore. The IP3R family in mammals includes three isoforms (IP3R1, IP3R2, and IP3R3), each sharing over 60% amino acid sequence similarity and exhibiting a common domain architecture. The structural and functional diversity of IP3R isoforms underscores their broad biological significance and potential implications in various genetic disorders, making them a focal point for ongoing biomedical research. However, the precise influence of the N-terminal domain dynamics on IP3 binding across various IP3R isoforms has yet to be fully elucidated. To address this, we performed a systematic in-silico domain swap analysis focusing on the N-terminus (NT) of different IP3R isoforms, which is structurally divided into the suppressor domain (SD, residues 1-223) and the IP3-binding core (IBC, residues 224–604). Our all-atom molecular dynamics simulations revealed essential movements including the significant twist motion of the SD and the correlated clam closure dynamics of the IBC upon IP3 binding, consistent with our previous findings. Further, the integration of coarse-grained models with Markovian pathways provided a comprehensive understanding of the conformational shifts and metastable state transitions observed. The atomistic details captured by the free energy landscape from the simulations explained variations in binding affinity across different IP3R systems, highlighting the pivotal role of the SD in modulating the overall dynamics of the IBC and influencing IP3 binding. These insights are crucial for understanding the conformational changes essential for channel gating and further elucidate the mechanistic basis of IP3R function.

## Poster distribution

	Name	PhD/MPhil programme	Title
P1	Aiyer, Rick	Master of Law	The Human Rights Aspects of Corporal Punishment: Realizing Children's Overdue Entitlement to Equal Protection from Assault
P2	Alós López, Martí	PhD in Society and Culture: History, Anthropology, Art and Heritage	Theatre in Times of Transition: The Value of Studying Theatre in Understanding the Spanish Transition
P3	Alves Passing, Vivien	PhD in Materials Science	Collagen Scaffolds as a Substrate for Lung Tissue Engineering
P4	Andrés Molina, Constantino	PhD in Genetics	A Green Bright Future. CRISPR-Cas9 and GFP in the Study of <i>Oikopleura dioica</i>
P5	Baltas, Elisavet	PhD in Oceanography	Idealised Modelling for Ocean Carbon Dioxide Removal
P6	Bertólez, Toni	PhD in Physics	The Universe on a USB stick
P7	Blanco Gabella, Patricia	PhD in Biomedicine	Development of novel non-peptidic VHL binders using a fragment-based approach
P8	Busquets de Jover, Eulàlia	PhD in Physics	Sea Surface Temperature (SST) Updating Impacts on WRF Model over Northwestern Mediterranean Sea
P9	Casabona Cendra , Lluís	PhD in Physics	Organic Phototransistors for Near-Infrared Light Detection
P10	Esteruelas Navarro, Gerard	PhD in Drug Research, Development and Control	Application of Nanomedicine in Neurodegenerative Diseases
P11	Jorda Santana, Elena	PhD in Business	Has the Covid-19 Pandemic Crisis Acted as a Mitigating Effect on the Relationship between Integrated Reporting Quality (IRQ) and the Cost of Debt of Companies (Kd)?
P12	Kallifronas, Dimitrios	Postdoc in Engineering	Thermoacoustic response of non-swirling and swirling lean premixed flames
P13	Kim, Min	PhD in Biological Sciences	Understanding the Mechanism of Trichome Development in <i>Hibiscus Trionum</i>
P14	Leow, Chen Yen	MPhil in Biological Sciences	Regulatory Roles of Cell-Cell Adhesions in Primitive Endoderm Specification
P15	Linares Figueruelo, Alejandra	PhD in Society and Culture: History, Anthropology, Art and Heritage	Global Museums, Local Stories: Satellite Museums amidst New Cultural Cartographies
P16	Neng, Wenzheng	PhD in Pharmacology	Identification and Validation of New In-silico Designed MYC binders For the Design of PROTACs
P17	Pathirage, Jivanka Kavishan	MPhil in Engineering for Sustainable Development	Integrating Renewables in the Sri Lankan Energy System – A Leapfrogging Approach
P18	Quílez Relaño, Gerard	PhD in Social and Organizational Psychology	Dialogic process in masculinity development in public spaces
P19	Sampietro Pifarre, Anna	PhD in Organic Chemistry	Discovering the amyloid antiaggregating potential of new dual sEH-AChE inhibitors for the treatment of Alzheimer's disease
P20	Shang, Linying	PhD in Chemistry	3D Porous Electrodes in Living Biophotoelectrochemical Systems: Insights for Optimal Electrode Design
P21	Sidro Inglés, Martí	PhD in Organic Chemistry	Synthesis of bioactive nitrogen-containing compounds via metal-catalyzed asymmetric hydrogenation
P22	Triantafyllidou , Chara	PhD in Theoretical and Applied Linguistics	Lost and Found: Navigating Ambiguity in Bilingualism
P23	Vicente-Sastre, Diego	PhD in Biodiversity	Non-breeding carry-over effects on the breeding performance of three long-lived migratory seabirds
P24	Zhu, Yu	PhD in Pharmacology	Molecular Characterization Unveiling Inositol 1,4,5-triphosphate (IP3) Binding Effect Determined by the IP3 Receptor N-terminal Domain