L-Università ta' Malta

Research Expo 2023

PROGRAMME & ABSTRACTS

Wednesday 17 May 2023

Table of Contents

UM Research Expo 2023

An unprecedented amount of research is being carried out at the University of Malta (UM) across many areas, yet this research rarely gets the exposure it deserves. Research Expo 2023 (UMRE23) is intended to give UM researchers the opportunity to showcase their research activities to the wider UM community, to encourage the sharing and cross-pollination of ideas, and to celebrate the success we have achieved thus far. UMRE23 also incorporates the traditional Doctoral School Symposium – allowing us to also celebrate the up-and-coming research of doctoral students.

Organising Committee

Prof. Inġ. Simon G. Fabri *(Chair)*
Dr Christian Bonnici
Prof. Noellie Brockdorff
Ms Lucienne Bugeja
Mr Pierre Cassar
Mr David Mizzi
Prof. Nicholas Vella
Ms Maronia Schembri

Scientific Committee

Prof. Inġ. Simon G. Fabri *(Chair)*
Prof. Noellie Brockdorff
Prof. Josanne Vassallo
Prof. Nicholas Vella

Editing of Programme

Ms Noeleen Mifsud

Design & Layout
Marketing, Communications & Alumni Office

Programme

08:00 – 09:00 **Registration**

09:00 – 09:30 **Introduction and welcome address**
Prof. Alfred J. Vella, Rector
Prof. Inġ. Simon G. Fabri, Pro-Rector for Research and Knowledge Transfer

09:30 – 10:30 **PLENARY SESSION**
CHAIR: Prof. Inġ. Simon G. Fabri | **VENUE:** Aula Magna, Level 1
See pages 12–15 for Abstracts

09:30 – 09:40 **Untangling ALS in Malta: From Genes to Mechanisms**
Prof. Ruben J. Cauchi

09:40 – 09:50 **Multimodal Encounters: Insights From an Ongoing Pedagogical Research Venture**
Dr George Cremona

09:50 – 10:00 **Ethical Issues in Multilingual Research Situations: A Focus on Interview-based Research**
Dr Natalie Schembri

10:00 – 10:10 **Satellite Data for Heritage: Studying Traditional Roofs From Space**
Prof. JoAnn Cassar

10:10 – 10:20 **Web Accessibility and Severe Motor Impairments – Research at the HCI Lab**
Dr Chris Porter

10:20 – 10:30 **Small Fish, Big Potential: Using Zebrafish to Identify Novel Drug Targets**
Dr Melissa Marie Formosa

10:30 – 11:00 **Networking Event With Plenary Session Presenters**
Coffee will be served (First Floor)

11:00 – 11:30 **KEYNOTE ADDRESS**
Introduced by Prof. Nicholas Vella, Director, Doctoral School

Collective Academic Supervision: Diversity as a Driver of Learning
Prof. Helle Merete Nordentoft, Aarhus University, Denmark

11:40 – 13:00 **Parallel Sessions**
See pages 17–45 for Abstracts

DOCTORAL STREAM DS1.1 | Humanities

CHAIR: Prof. Vincent Cassar | **VENUE:** Meeting Room 2, Level 0

11:40 – 12:00	**Small Island States and Resilience Building During the COVID-19 Pandemic: The Case of Tourism** Mr Luca Nguyen
12:00 – 12:20	**The Four Principles of Good Global Governance to Address the Ecological Crisis** Dr Roberto Debono
12:20 – 12:40	**A Theoretical Contextualisation of International-structural Impediments to Democratisation in the Global South** Mr Joseph M. Debono
12:40 – 13:00	**Latin on Screen: Discovering Perception and Exploiting Potential** Ms Maria Giuliana Fenech

DOCTORAL STREAM DS1.2 | Architecture and STEM

CHAIR: Prof. Inġ. Kenneth P. Camilleri | **VENUE:** Meeting Room 3, Level 0

11:40 – 12:00	**Investigating Hybrid Turbo-Electric Propulsion Systems (HTEPS) for Regional Aircraft** Mr Aman Batra
12:00 – 12:20	**On Engineless Taxiing With Autonomous Electric Tow Trucks** Inġ. Stefano Zaninotto
12:20 – 12:40	**The Technology of Baroque Oil-Based Wall Paintings in Malta: Materials and Implications for Conservation** Ms Roberta De Angelis
12:40 – 13:00	**Coordinated Coverage Control With a Multi-robot Team** Inġ. Rachael Nicole Duca

DOCTORAL STREAM DS1.3 | Social and Behavioural Sciences / Life Sciences and Medicine / STEM

CHAIR: Prof. Joseph M. Cacciottolo | **VENUE:** Meeting Room 4, Level 0

11:40 – 12:00	**The Social and Cognitive Correlates of Worldviews** Ms Rebekah Mifsud
12:00 – 12:20	**Genetic Variants in Corneal Dystrophy Genes: A Maltese Cohort Study. Inhibition of TGFBI as a Treatment Modality** Ms Gabriella Guo Sciriha
12:20 – 12:40	***De Novo* Genomic Studies of Endemic Plants in the Genus *Limonium*** Ms Dorita Agius
12:40 – 13:00	**Variational Gibbs State Preparation on NISQ devices** Mr Mirko Consiglio

EXPO STREAM ES1.1 | Social and Behavioural Sciences / Life Sciences and Medicine

CHAIR: Dr Stephen Lungaro Mifsud | **VENUE:** Meeting Room 5, Level 0

11:40 – 11:50	**Exploring Placemaking and Experimentation Processes for the Transformation of Public Space in Malta** Dr Sarah Scheiber | *Co-researcher:* Dr Wendy Jo Mifsud
11:50 – 12:00	**TRACtion – Tradition in Action** Dr Zoi Arvanitidou | *Co-researcher:* Dr Lorraine Portelli
12:00 – 12:10	**University Academic Lectureship pathways** Dr Maria Cutajar
12:10 – 12:20	**Understanding the Applicability of the Timed Cities Concept to the Maltese Context** Dr Sarah Scheiber | *Co-researchers:* Dr Therese Bajada; Dr Wendy Jo Mifsud
12:20 – 12:30	**The Entrepreneurial Environment Framework** Prof. Russell Smith
12:30 – 12:40	**Beyond Pandemics: Improving Climate Resilience and Health Systems In Small Islands** Dr Stefano Moncada
12:40 – 12:50	**Tourism in European Cities: The Visitor Experience of Architecture, Urban Spaces and City Attractions** Dr John Ebejer
12:50 – 13:00	**Barriers to Staff Attendance at the Basics in Medical Education (BiME) Course Organised by the Faculty of Medicine and Surgery, University of Malta: A Case Study Approach** Dr Petramay Attard Cortis

EXPO STREAM ES1.2 | Life Sciences and Medicine

CHAIR: Prof. Richard Muscat | **VENUE:** Meeting Room 6, Level 0

11:40 – 11:50	**The Thalassemia Project; Quantitative Epidemiology of Human Haemoglobin and the Pathophysiology of Developmental Globin Gene Control** Prof. Alex Felice | *Co-researchers:* Prof. Christian Scerri; Prof. Joseph Borg; Ms Ruth Galdies
11:50 – 12:00	**Reduction in Size of a Novel Hip Joint Replacement: A Numerical Study** Dr Leonardo Fanton
12:00 – 12:10	**Translational Stroke Research** Prof. Mario Valentino
12:10 – 12:20	**Harnessing Phage Display Technology for Accelerated Antiviral Therapeutics Discovery** Ms Giuseppina Monda
12:20 – 12:30	**Bioinformatics for Multi-omics (BioGeMT)** Dr Panagiotis Alexiou
12:30 – 12:40	**Tuning in and out: A Brain Electrical Routing Mechanism During Working Memory** Dr Nowell Zammit

EXPO STREAM ES1.2 | Life Sciences and Medicine *(Continued)*

12:40 – 12:50	**Brain White Matter Injury: Pathophysiology and Future Therapeutic Targets** Dr Christian Zammit
12:50 – 13:00	**Predicting Explainable Drug-Drug Interactions Using Knowledge Graphs** Ms Lizzy Farrugia | *Co-researchers:* Dr Jeremy Debattista; Prof. Lilian Azzopardi; Dr Charlie Abela

EXPO STREAM ES1.3 | Life Sciences and Medicine

CHAIR: Prof. Josanne Vassallo | **VENUE:** Meeting Room 103, Level 1

11:40 – 11:50	**Detection of an Immune Cell Population With Both Lymphocytic and Monocytic Characteristics in Pituitary Tumours** Dr Oriana Mazzitelli
11:50 – 12:00	**Electromagnetic Hyperthermia for Breast Cancer** Dr Lourdes Farrugia
12:00 – 12:10	**Assessing the Differential Gene Expression Profiles in Human Growth-hormone (GH) Secreting and Non-Functioning (NF) Pituitary Tumours Using Transcriptomic Analysis** Ms Emma Jayne Spiteri
12:10 – 12:20	**Project PADLOCK: Discovering Novel Antibodies Targeting Multiple Immune Checkpoints for Enhanced Cancer Immunotherapy** Prof. David George Saliba
12:20 – 12:30	**Using Fruit Flies to Gain Insights into the Neuromuscular Complications of COVID-19** Dr Paul Herrera
12:30 – 12:40	**Maltese Algae for Health Food** Prof. Gabrielle Zammit
12:40 – 12:50	**Ecological Niche Modelling for Arthropod Habitats in the Circum-Sicilian Islands** Dr James Ciarlo
12:50 – 13:00	**Two Decades of Specialist Nurses in Malta** Dr Corinne Scicluna

EXPO STREAM ES1.4 | Architecture and STEM

CHAIR: Prof. Inġ. Andrew Sammut | **VENUE:** Aula Magna, Level 1

11:40 – 11:50 **Design and Stress Analysis of Fusion Reactor Systems**
Prof. Inġ. Pierluigi Mollicone

11:50 – 12:00 **Creep Fatigue Assessment of DEMO Fusion Reactor Divertor Components**
Prof. Inġ. Martin Muscat

12:00 – 12:10 **User Requirements for Sustainable and Smart Packaging**
Ms Tamasine Camilleri

12:10 – 12:20 **Coordinated Energy Storage for Low Carbon Power Networks**
Dr Somesh Bhattacharya

12:20 – 12:30 **Using Nature's Resources to Make Composites More Sustainable**
Dr Brian Ellul Grech

12:30 – 12:40 **Surface Engineering of Metallic Orthopaedic Alloys Using Commercial Treatments**
Dr Antonino Mazzonello

12:40 – 12:50 **Nanoplastic Fate and Ageing Behaviour**
Dr Sophie Briffa

12:50 – 13:00 **High-speed Permanent Magnet Synchronous Machine Design for the Flywheel Energy Storage System Application**
Ms Xuewen Lian

13:00 – 14:00 **Lunch and coffee** *(Courtyard)*

14:00 – 15:00 **POSTER SESSION AND NETWORKING**
VENUE: Level 0
See pages 66–88 for Abstracts

15:00 – 16:00 **Parallel Sessions**
See pages 46–64 for Abstracts

DOCTORAL STREAM DS2.1 | Architecture and STEM

CHAIR: Prof. Emanuel Buttigieg | **VENUE:** Meeting Room 2, Level 0

15:00 – 15:20 **Piezoelectric Micro-machined Ultrasonic Transducers Optimised for Intra pore Deployment in Reinforced Concrete Structures**
Inġ. Stephen Sammut

15:20 – 15:40 **Towards Sustainable Injection Moulding Using 3D Printed Conformal Cooling Channels: A Comparative Simulation Study**
Ms Rebecca Clark

DOCTORAL STREAM DS2.2 | Architecture and STEM

CHAIR: Prof. Inġ. Jonathan Borg | **VENUE:** Meeting Room 3, Level 0

15:00 – 15:20	**PREMIER: A Research Project on Smart, Emotionally Pleasing Above Knee Prosthesis** Mr Nicholas Patiniott
15:20 – 15:40	**Micro-Electro-Mechanical-System (MEMS) Gripper for Biomedical Applications** Inġ. Thomas Sciberras
15:40 – 16:00	**Mathematical Modelling of Metabolism, With Applications on the Bacteria Campylobacter Jejuni** Ms Yanica Said

DOCTORAL STREAM DS2.3 | Social and Behavioural Sciences / Life Sciences and Medicine

CHAIR: Mr Andras Havasi | **VENUE:** Meeting Room 4, Level 0

15:00 – 15:20	**A Mixed Methods Systematic Review of the Issues Which Marginalise Females With ADHD** Ms Sarah Cilia Vincenti
15:20 – 15:40	**Investigating the Molecular Mechanisms of Combination Therapy on Drug-Resistant Chronic Myeloid Leukaemia** Mr Antonio Polidano Vella

EXPO STREAM ES2.1 | Humanities, Education and Law

CHAIR: Dr Charles Farrugia | **VENUE:** Meeting Room 6, Level 0

15:00 – 15:10	**Beyond the Temples: Climatic, Landscape, and Ecological Perspectives on Maltese Prehistory** Dr Huw S. Groucutt
15:10 – 15:20	**Ensuring Access to Tertiary Education for Students With Disability** Prof. Paul A. Bartolo
15:20 – 15:30	**What are They Eating? Developing Tools to Explore Maltese Young Children's Dietary Patterns** Prof. Suzanne Piscopo
15:30 – 15:40	**Immunity (or Vaccine) Passports: A History of a Document** Dr Marc Kosciejew
15:40 – 15:50	**Food Security Among Community-living Elderly: A Case Study in Malta** Dr Karen Mugliett

EXPO STREAM ES2.2 | Architecture and STEM

CHAIR: Dr Inġ. Simon Borg | **VENUE:** Aula Magna, Level 1

15:00 – 15:10	**The megalithic Temples of Malta are UNESCO World Heritage Sites: Evaluating the Performance of the Open Sided Protective Shelters** Ms Rosangela Faieta
15:10 – 15:20	**Conservation of the Pérez d'Aleccio Great Siege Wall Painting Cycle: Research and Implementation** Prof. JoAnn Cassar
15:20 – 15:30	**Monitoring Knowledge Risks Through Living Mathematical Models of Human Activity** Dr Mark Micallef
15:30 – 15:40	**Groundwater Monitoring From Ambient Seismic Noise** Dr Matthew Agius
15:40 – 15:50	**Documenting the Spread of Marine Invaders Through Two National Citizen Science Campaigns** Prof. Alan Deidun
15:50 – 16:00	**Cosmology From the Moon** Prof. Kristian Zarb Adami

EXPO STREAM ES2.3 | Architecture and STEM

CHAIR: Prof. Ian Thornton | **VENUE:** Meeting Room 103, Level 1

15:00 – 15:10	**Self-screening Electrical Impedance Mammography** Prof. Cristiana Sebu
15:10 – 15:20	**3D Reconstruction and Immersive Applications** Ms Tram Thi Ngoc Nguyen
15:20 – 15:30	**Reducing Energy Generated Intermittency Through Voltage Regulation** Dr Oussama Guellout
15:30 – 15:40	**ATLANTES** Ms Ritu Kandari
15:40 – 15:50	**Towards the Synthesis of Molecular, Auxetic Networks** Dr Maria Cardona
15:50 – 16:00	**Graph Domination, Graph Isolation and the Art Gallery Theorem** Prof. Peter Borg

16:15 – 16:30	**Conclusion** *(Aula Magna)*

Programme is subject to last-minute changes

ABSTRACTS

Plenary Session

CHAIR: **Prof. Inġ. Simon G. Fabri**

Untangling ALS in Malta: From Genes to Mechanisms

Prof. Ruben J. Cauchi

Department of Physiology & Biochemistry, Faculty of Medicine & Surgery

Genetic risk for amyotrophic lateral sclerosis (ALS) is highly elevated in genetic isolates, like the island population of Malta, providing a unique opportunity to investigate the genetics of this disease. In this oral presentation, the clinical phenotype and genetic profile of the largest series of Maltese ALS patients to date will be briefly highlighted. The genes in which potentially damaging variants or repeat expansions have been identified will be discussed. The genetic data analysed thus far will demonstrate that the Maltese population is an outlier within Europe and one that has a high percentage of genetically explained cases. Importantly, we will showcase our work aimed at characterising identified ALS genes in the fruit fly or Drosophila model system. Our findings support the notion that loss of function of these genes is a meaningful contributor to ALS. Importantly, through use of transcriptome profiling, we pinpoint pathways that are dysregulated as a result of gene loss, allowing us to arrive at mechanisms that can be targeted by precision medicine for the benefit of ALS patients.

Multimodal Encounters: Insights From an Ongoing Pedagogical Research Venture

Dr George Cremona

Department of Languages & Humanities Education, Faculty of Education

Kress and Van Leeuwen (2010) define multimodality as the use of several semiotic modes in the design of a semiotic product or event. The starting point for multimodality is to extend the social interpretation of language and its meanings to the whole range of representational and communicational modes or semiotic resources for making meaning that are employed in a culture – such as image, writing, gesture, gaze, speech and posture. Jewitt (2017, p. 1) elaborates that 'there is increasing interest among academics, professionals and students in the role of image, gesture, gaze, posture, the use of space in representation and communication – in other words – multimodality. These modes are understood as intimately connected, enmeshed through the complexity of interaction, representation, and communication'. In the proposed interactive 5-minute presentation, directly involving the audience, I intend to share results and outcomes obtained from the ongoing Multimodal Experiences research project. This project constantly involves key stakeholders in relation to schoolings (i.e. policymakers, educators including teachers and LSEs, as well as students and their parents) and collects data from within actual learning contexts. The presentation will focus on the way the project critically investigates the pros and cons of multimodal texts while students learn in class. As a conclusion, I also intend to share with the audience insights about the way the project contributes to the field of knowledge by implementing and designing different multimodal tools and texts which very often serve in facilitating student-centred task-based learning and teaching.

Ethical Issues in Multilingual Research Situations: A Focus in Interview-based Research

Dr Natalie Schembri

Institute of Linguistics & Language Technology

Interview-based research in multilingual situations presents researchers with specific ethical challenges relating to language-based power play, data handling and presentation. Studies indicate favouring the L1 as an interviewing language may produce better quality data but existing pressures can work in favour of English as the dominant research language. This study examines researcher perception and experience of the ethical consequences of language choice and the practical issues involved from the standpoint of Aristotelian virtue theory. Interviews were conducted with five European researchers working on an interview-based COST project with experiences of diverse interviewing scenarios. The study revealed a nuanced picture of ethical issues in both L1- and English-oriented scenarios involving potential misrepresentation and deculturalisation of the data in the former and language-based power asymmetries in the latter. The study highlights the importance of documenting ethics-related methodological details of language use and advocates publication practices favouring the inclusion and foregrounding of L1 data. It also contends the academy has a role to play in the formation and education of researchers who are aware of the language-related issues that multilingual interview-based research entails.

Satellite Data for Heritage: Studying Traditional Roofs From Space

Prof. JoAnn Cassar

Department of Conservation & Built Heritage, Faculty for the Built Environment

"Cool roofs" are a modern technology, based in part on the known behaviour of "traditional flat roofs" all around the Mediterranean. The latter have the additional advantage of using "breathable" i.e., porous, materials preventing heat accumulation during the hot summer months, also through evaporative cooling, also the basis of another "new" technological development. The behaviour of these roof types is being studied in an innovative way, focussing on temperature and moisture data, employing high resolution satellite data, UAV (Unmanned Aerial Vehicle) multispectral technology (visible, near- and thermal-infrared wavelengths) and direct measurements on, and underneath, the roofs of selected buildings, correlating the data obtained with the known composition of the studied roofs, and comparing to modified and modern roof types. This research will determine the real behaviour of such roofs, promoting an understanding of their performance, the ultimate aim being the promotion of sustainable preservation and maintenance of such heritage buildings.

Web Accessibility and Severe Motor Impairments – Research at the HCI Lab

Dr Chris Porter

Department of Computer Information Systems, Faculty of Information & Communication Technology

People living with severely limited motor abilities, including locked-in individuals, are largely underserved when it comes to accessing the internet – and in turn, all that it affords. This includes activities which are at the core of what it means to be human, including connecting and communicating with other people, learning, working and playing. This talk will outline interdisciplinary research being carried out at the Human-Computer Interaction Lab (HCI Lab), within the Faculty of ICT in collaboration with the Systems and Control Engineering Department within the Faculty of Engineering. More specifically, two projects will be outlined through which we are investigating and leveraging eye-gaze data as well as brain-signals as input modalities for novel web browsers being developed within the lab. As part of our investigation, we are also looking at affordability and adoption outside of a lab environment, in turn minimising barriers to entry. Apart from the core algorithms being developed to drive these browsers, we are also looking at aspects related to ergonomics and long-term use. For this reason, we are placing significant emphasis on ISO 9241 attributes, including interaction efficiency, throughput and usability. This work is also supported by a network of national and international stakeholders who contribute through domain expertise.

Small Fish, Big Potential: Using Zebrafish to Identify Novel Drug Targets

Dr Melissa M. Formosa

Department of Applied Biomedical Science, Faculty of Health Sciences

Osteoporosis, the most common type of bone disorder, with a high fracture incidence, affects more than 200 million people worldwide. Effective treatment that successfully restores bone integrity without concomitantly inflicting undesirable side-effects is limited, creating the need for identifying improved therapy using simple, fast, and robust assays to reduce the osteoporosis treatment gap. The ZeEBRA project will use genetically modified zebrafish as an improved and robust model for high-throughput screening of small molecules to identify new drug candidates for treating bone disorders. This will help achieve an active ageing population, promote healthy living, and boost the economy. The project is a collaborative effort between researchers from the University of Malta (Lead Partner), AquaBioTech Limited (Project Partner) and Radboud University, Nijmegen, The Netherlands. The project is being undertaken as part of a Technology Development Programme (R&I-2019–018) funded by the Malta Council for Science and Technology, and is aimed to identify novel drug targets that will be patented.

Keynote Address

Collective Academic Supervision: Diversity as a Driver of Learning

Prof. Helle Merete Nordentoft

Aarhus University, Denmark

Traditionally, supervision of Ph.D. and master's theses has been performed individually. However, previous research has identified various problems with this approach. Several studies have exposed the vulnerability of the individualised supervisor–student relationship, with students and supervisors alike reporting issues including the difficult balance between authority and independence – e.g. an over-reliance on the supervisor, in particular in postgraduate supervision – personality clashes, loneliness, and a lack of ownership (Dysthe, Samara & Westrheim, 2006). Collective Academic Supervision (CAS) is a research-based and innovative model for participation and learning in higher education (Nordentoft, Thomsen & Wichmann-Hansen, 2013). It offers a response to these challenges, as well as addressing the need for interdisciplinary and collaborative research exploring complex problems in both natural and human sciences and developing solutions. Inspired by sociocultural learning theory, the model incorporates a progressive and systematic interaction between students in their individual writing processes and integrates the notion that learning and participation are interconnected. Moreover, diversity in supervision groups is seen as a driver of both collective and individual learning. In my keynote, I will expand on the rationale for the CAS model, its theoretical foundations, and how it can be put into practice within higher education. Finally, I will address the challenges both supervisors and supervisees may experience when participating in CAS (Wichmann-Hansen, Thomsen & Nordentoft, 2015).

Doctoral Stream DS1.1

Humanities

CHAIR: **Prof. Vincent Cassar**

Small Island States and Resilience Building During the COVID-19 Pandemic: The Case of Tourism

Mr Luca Nguyen

Islands & Small States Institute

The aim of this Ph.D. research is to assess the level of resilience in small island states (SIS) heavily dependent on tourism and to explore the contribution of top-down and bottom-up approaches to enhancing resilience in response to the exogenous shock caused by the COVID-19 pandemic.

Despite the traditional view of SIS as highly vulnerable to external crises (Guillaumont, 2010), in past crises some SIS have demonstrated the ability to build resilience to withstand, recover or minimise the effects of exogenous shocks (Briguglio, 2010). While the majority of research has primarily focused on top-down measures implemented by governments (Briguglio, 2016), another important aspect of resilience has been the resourcefulness of individuals and communities, relying on the social capital and community solidarity embedded in the sociocultural ecology of small islands (Baldacchino, 2019). These two strands of research are mostly studied separately with few points of contact. This study used a mixed methodology to investigate both top-down and bottom-up resilience dynamics and their interaction in touristic SIS during the COVID-19 shock.

The results of this study highlight the importance of an integrated theoretical approach that considers both top-down and bottom-up resilience. Such an approach can be highly effective in understanding and interpreting resilience building and supporting SIS in reducing negative impacts from external shocks. This presentation will examine the findings of the study and offer recommendations for future research and policy action.

The Four Principles of Good Global Governance to Address the Ecological Crisis

Dr Roberto Debono

Department of Philosophy, Faculty of Arts

The urgency to address the global ecological crisis arguably requires the existence of a global guardian – a constitutionally limited legitimate coercive global authority – capable of enforcing binding global agreements. The idea of a coercive global authority arguably evokes the fear of a global Leviathan – 'a soulless despotism' according to Immanuel Kant or, in Hans Morgenthau's words, 'a totalitarian monster resting on feet of clay'. This paper will describe four principles of good global governance to address the ecological crisis: sufficiency, subsidiarity, democracy and solidarity. Sufficiency narrows the scope of the global guardian to issues exclusively related to ecological sustainability. Subsidiarity supports multi-layered global governance where decisions are taken at the hierarchically lowest possible levels. Democracy ensures that the global process is owned by the member states. Solidarity evokes a duty to assist, in Rawlsian terms, 'burdened societies' to partake in the process and keep pace with the ecological transformation. Observance of these four principles should allay fears of a legitimate coercive global authority, secure the global guardian's legitimacy and safeguard the global guardian's mission to steer humankind towards ecological sustainability. It will be argued that, together, these four principles should be sufficient conditions for good global governance to address the ecological crisis.

A Theoretical Contextualisation of International-structural Impediments to Democratisation In the Global South

Mr Joseph M. Debono

Department of International Relations, Faculty of Arts

I argue that international structures, fashioned by powerful states and mediated by international financial institutions in the general interest of those states, made it impracticable for democratically elected Tunisian governments in the post-Ben Ali era to be responsive to the demands of the Tunisian population, as expressed during and after the Tunisian Revolution. It is this factor – the lack of democratic responsiveness – that gradually eroded trust in democratic institutions and led to the popularly sanctioned democratic backsliding in Tunisia, in 2021. To illustrate this theoretically, I combine structural theories of IPE with theories that focus on democratic responsiveness. Some theoretical constructs emanating from the Structuralist school, such that of 'Accumulation by Dispossession,' that of 'Responsibilisation,' as well as that of the global rise of the 'Precariat,' serve to shed light on the ways in which capitalist structures counteract democratic values and principles, especially in the developing world. The notion of structural power, pioneered by Strange (1988) and developed by Gwynn (2018), will serve as the theoretical lynchpin that will steer the analysis while also connecting the structuralist paradigms pertaining to the effects of capitalist structures on democracy to the notion of democratic responsiveness. Finally, the notion of democratic responsiveness – or the lack thereof – is seen as encapsulating the undesirable upshots of capitalist structures on democratic orders and is invoked in this study for its capacity to explain how the structural power of capital may ultimately lead, through the creation of a situation of a protracted responsiveness deficit in a newly formed democracy, to democratic backsliding and authoritarian resurgence.

Latin on Screen: Discovering Perception and Exploiting Potential

Ms Maria Giuliana Fenech

Department of Classics & Archaeology, Faculty of Arts

Despite the decline of Latin and the loss of its role as the passport into academia, the persistent presence of the language in, inter alia, cinema and television proves that Latin is still alive and well. The Latin language in these productions is not only quotations from ancient authors but also 'new Latin', written especially for the project in question. When one considers that these are not intended for a select academic audience, but instead for a general audience, the question of Latin's function in the industry and its role in the perpetuation of the language arises. Therefore, the Latin used in cinema and television warrants academic attention not only from a linguistic point of view but also because it has a considerable effect on the reception and further study of classics.

Audiences' perception of Latin language scenes on screen has been relegated to a minor role in classical reception studies. This presentation shall analyse the results of two surveys, one conducted among post-secondary students, and one among adults. Survey findings reveal audiences' awareness of Latin cinema, their ability to recognise that Latin is being spoken on screen, and the possible application of Latin cinema in language learning promotion. This will be followed by an examination of the appropriateness of film in supporting the linguistic and cultural aims of Latin teaching in relation to opposing pedagogical trends in Latin teaching, namely the grammar-translation method and the Induction/ Immersion method. Finally, practical approaches are suggested for making optimal use of film, by striking a balance between its linguistic advantages and cultural possibilities.

Doctoral Stream DS1.2

Architecture and STEM

CHAIR: **Prof. Inġ. Kenneth P. Camilleri**

Investigating Hybrid Turbo-Electric Propulsion Systems (HTEPS) for Regional Aircraft

Mr Aman Batra

Institute of Aerospace Technologies

This research investigates Hybrid Turbo-Electric Propulsion Systems (HTEPS) for regional aircraft. Sustainability and emissions reduction is urgent due to effects of climate change, also suggested by the Intergovernmental Panel on Climate Change (IPCC) 2022 report and the drive to net zero emissions. The European Union (EU) has been very aggressive in its goals to decarbonise aviation. Its strategy is highlighted in the Flightpath2050 document which targets reducing in-flight CO2, NOx and noise. To achieve these goals, electric, hydrogen-based and sustainable aviation fuel-based aircrafts are being researched worldwide.

Electric propulsion has advantages such as low emissions, less noise and augmented efficiency. Additionally, battery energy density above 800 Wh/kg is required to sustain a large transport aircraft (Airbus-A320/Boeing-B737) with a typical 1,111 km range. With the value of current battery energy density (200–250 Wh/kg) doubling every 23 years, it will take around five decades to achieve electrification targets. In the near future, electric propulsion would be unable to achieve range-endurance as present aircraft.

To fill this gap, HTEPS is proposed with electric powertrain and gas turbine working concurrently. It may yield benefits in short-haul turboprops (like ATR 72) performing over 40% of all commercial flights.

This research therefore focuses on theoretical derivation of important performance parameters for hybrid-electric aircraft, such as range and endurance. It considers a case study of a short-haul regional aircraft to show trade-offs between battery weight, payload, range, and fuel consumption. The research aims to produce a technological roadmap for scaling of the application to HTEPS single aisle aircraft.

On Engineless Taxiing With Autonomous Electric Tow Trucks

Inġ. Stefano Zaninotto

Institute of Aerospace Technologies

The growth of air traffic during the last decades has brought a deep impact on the environment in terms of fuel emissions, air pollution and noise pollution. In particular, during the last years the ground phase of the flight mission (i.e. taxiing) is receiving particular attention. In fact, the aircraft's engines are not optimised for taxiing purposes; besides this, a situation of high traffic level inside the airport could lead to congestion on the airport's taxiways and to repeated stop-and-go movements of the aircraft. These factors make taxiing one of the biggest contributors to pollution and noise at airports.

One of the solutions proposed by the aerospace industry is to introduce electric trucks to tow aircraft from the stand to the runway (or vice-versa). However, the introduction of tow trucks increases surface traffic which, from an Air Traffic Controller's point of view, is undesirable. Many solutions have been proposed to mitigate this increase in workload through the introduction of automated planning and execution. However, most of these solutions suffer severe limitations, such as the inability to schedule and plan routes for multiple runways simultaneously, the incapability to consider battery state-of-charge when assigning tow trucks and limited testing phases.

This work details a novel algorithm for taxi operations using autonomous tow trucks in order to improve ground operations and overcome some of the limitations of existing solutions. The system identifies conflict-free solutions that minimise delays and taxi route lengths, while maximising the use of tow trucks for taxi operations.

The Technology of Baroque Oil-Based Wall Paintings in Malta: Materials and Implications for Conservation

Ms Roberta De Angelis

Department of Conservation & Built Heritage, Faculty for the Built Environment

Oil-based painting on stone is the most common painting technique used to decorate churches and historical palaces in Malta since the 17th century. It is characterised by having oil paint applied directly to a porous support – Globigerina Limestone. These paintings are often found in critical conservation conditions as a result of their inherent properties and the aggressive marine environment. Understanding the materials composing these paintings and the way they deteriorate is the first essential step to inform conservation strategies and implement safe treatments.

This research considers the significance of the results of the study of 19 oil paintings, undertaken using a range of non-invasive and invasive techniques of investigation. The research has a specific focus on targeted degradation phenomena inherent to the ageing of oil painting, extensively studied in easel paintings at international level but often overlooked in wall paintings.

This contribution will show that the technique used in oil-based wall painting is more complex and sophisticated than what has been hitherto acknowledged within the local and international context, even in the case of less prestigious commissions including ornamental wall paintings. It will also explain the impact that paint degradation processes have on the appearance and appreciation of these paintings, as well as on the design of conservation treatments, especially cleaning.

Coordinated Coverage Control With s Multi-robot Team

Inġ. Rachael Nicole Duca

Department of Systems & Control Engineering, Faculty of Engineering

Coverage control with a multi-robot system requires the robot team to be optimally distributed across some environment. Covering an environment efficiently is useful and necessary in a variety of applications such as surveillance or search and rescue. Such environments may present challenges such as consisting of multiple, distinct areas which have a higher importance than other areas in the same environment. The robots in the team may be heterogeneous in their type and sensor capabilities, and hence must be optimally allocated to different areas according to their capabilities. These areas may also be time-varying, hence the robots in the team must track the changes in these areas with time. Furthermore, the robots in the team may have actuator and battery constraints that have to be accounted for in the overall algorithm. In our research, we are developing an optimisation framework that allows a multi-robot team to cover an environment that has multiple, distinct areas of interest which are time-varying, when the team is subject to energy and sensor constraints. This framework is a modular framework that allows different algorithms to address specific tasks solved in the framework towards an efficient and effective coverage control solution.

Doctoral Stream DS1.3

Social and Behavioural Sciences / Life Sciences and Medicine / STEM

CHAIR: **Prof. Joseph M. Cacciottolo**

The Social and Cognitive Correlates of Worldviews

Ms Rebekah Mifsud

Department of Cognitive Science, Faculty of Media & Knowledge Sciences

Nowadays we find ourselves living in increasingly multifaceted and diverse societies. Consequently, it has become more imperative than ever to understand individual differences in order to promote social cohesion and impede perpetuating discrimination. A crucial domain of investigation that can foster such understanding is the relationship between our beliefs, cognitions, and behaviours. The focus of this presentation is to outline key social and cognitive correlates of particular sets of beliefs, referred to as worldviews. Worldviews encompass beliefs that shape one's outlook on life and are, therefore, instrumental in providing meaning to one's reality and one's understanding as to how one fits in it. Notably worldviews can be classified into five unique types, namely, Localised, Orthodox, Pragmatist, Reward, and Survivor. In this presentation I provide evidence for a relationship between social values and this five-factor typology. Results showed that worldviews may be mapped onto two value dimensions; openness to change versus conservation, and self-transcendence versus self-enhancement. Following this, I provide evidence for a relationship between self-regulatory cognitive mechanisms, namely, inhibitory control and cognitive flexibility, and worldviews. Worldviews that value conservation were shown to predict inhibitory control ability, whereas worldviews that value openness to change were shown to predict cognitive flexibility. Overall, the findings of this inquiry support the hypothesis that variations in cognitive processes give rise to divergent perceptions and experiences of the world. These dynamics further our understanding of how individuals unite around issues of common concern, contributing towards a more harmonious and cohesive society.

Genetic Variants in Corneal Dystrophy Genes: A Maltese Cohort Study. Inhibition of TGFBI as a Treatment Modality

Ms Gabriella Guo Sciriha

Department of Applied Biomedical Science, Faculty of Medicine & Surgery

The three objectives of this project were a) to establish which worldwide populations have a corneal dystrophy (CD) genetic makeup closest to that of the Maltese; b) to identify the causative mutation present in a Maltese family that exhibit granular corneal dystrophy 1 (GCD1), a subtype of TGFBI CDs; c) to explore TGFBI inhibition as a treatment modality.

Genetic prevalence of CD subtypes and fixation index (FST) values for Maltese SNPs were calculated. Clinical exome sequencing was performed on mouthwash samples from GCD1 phenotype individuals, to determine which GCD1 variant is present in Malta. A scoping literature review to identify and categorise compounds that decrease corneal TGFBIp (protein) levels was performed to explore their potential to be used as a cost-effective approach via drug repurposing.

FST values showed least differentiation with Puerto Rican, Mexican, and Colombian cohorts. The mutation in the GCD1 phenotype individuals was identified as R555W (TGFBI gene). 16 compounds that can theoretically reduce the levels of mutant TGFBIp in human corneal cells were identified.

The clinical exome sequencing study is the first CD genetic study that has ever been carried out on GCD1 Maltese individuals, thus generating new material about the previously unknown genetic pool present. Identifying populations with least genetic differentiation can guide future treatment strategies for Maltese individuals with CDs in the absence of comparable Maltese data. Surgical treatment of TGFBI CDs can be associated with serious complications and recurrence is almost universal. The introduction of drugs as a treatment option in CDs would be a breakthrough.

De Novo Genomic Studies of Endemic Plants in the Genus *Limonium*

Ms Dorita Agius
Centre for Molecular Medicine & Biobanking

The genome is the DNA sequence that makes up a complete set of chromosomes of a reduced gamete. It is transmitted from one generation to another to give the characteristics that enable survival of the individual and the species. It has the necessary information for development and regulation of biological processes to enable survival of the day-to-day stresses especially in sessile organisms such as plants. Advancements in high-throughput sequencing (HTS) and supporting bioinformatics are providing new opportunities to unravel the genomic characteristics that enable survival of the individual and the species.

Genomic studies are being carried out on the endemic plants Limonium melitense Brullo and L. zeraphae Brullo which inhabit the Maltese shoreline. These plants are exposed to the extreme environmental conditions of this marginal habitat. Due to multiple and often conflicting uses of this habitat, there is continuous encroachment on this habitat, threatening these species with extinction. Members of this genus have been shown to produce secondary metabolites that are pharmacologically active. In this research project, the genome model of these species has been generated using third generation long-read HTS and a number of bioinformatics tools. These genome models will be annotated with coding and non-coding genes, and epigenetic modifications identified. These will be utilised as a resource in the study of (i) evolution/speciation/taxonomic processes, (ii) pharmaceutical discovery, (iii) agricultural – halophytic adaptations, apomixis, plant growth on minimal resources, (v) biodiversity conservation studies, and (vi) adaptations to relevant extreme conditions in the light of climate change. By means of this research project, a pipeline will also be developed that will enable the genomic studies of other taxa.

Variational Gibbs State Preparation on NISQ Devices

Mr Mirko Consiglio
Department of Physics, Faculty of Science

A variational quantum algorithm is designed for the preparation of quantum Gibbs states, which have many applications in quantum simulation, quantum optimisation, and quantum machine learning. The main issue in variationally preparing a Gibbs state is the difficulty in measuring the von Neumann entropy on a quantum device. This issue is entirely alleviated by carefully constructing a parameterised quantum circuit that is able to determine the von Neumann entropy via simple post-processing of computational basis measurements, carried out on ancillary qubits. The preparation of Gibbs states in simulations and real quantum devices, across a broad range of temperatures, is certified by comparing the fidelity with the exact Gibbs states of the Ising Model.

Expo Stream ES1.1

Social and Behavioural Sciences / Life Sciences and Medicine

CHAIR: **Dr Stephen Lungaro Mifsud**

Exploring Placemaking and Experimentation Processes for the Transformation of Public Space in Malta

Dr Sarah Scheiber | *Co-researcher:* **Dr Wendy Jo Mifsud**

Department of Spatial Planning & Infrastructure, Faculty for the Built Environment

Research is ongoing to develop proposals to support and facilitate place led experimentation locally. The research adopts multiple case study and participant action research methodologies through the application of placemaking and urban living lab concepts. Dr Sarah Scheiber and Dr Wendy Jo Mifsud, teamed up with EcoStack Innovations to develop the project ReCreate (NatuRE-based Co-CREATion in SenglEa – Beauty in Diversity), an EU funded community project led by Ecostack Innovations in collaboration with Dawra Madwarna, Senglea Local Council and the University of Malta. ReCreate engaged the community to rethink streetscapes and public spaces as greener places, and foster a better relationship with nature for residents while improving the urban environment through nature-based placemaking. The research strives to understand how residents of Maltese localities can be motivated to participate in bettering the urban environment within which they live, and to ultimately foster a sense of pride in the spaces they make use of. To achieve this, a placemaking toolkit developed by Placemaking Europe is adapted, applied and analysed within the Maltese context, consisting of a series of events to build a relationship with local communities that allows the toolkit to be tailored to their specific needs and desires for their locality. In Senglea, a number of placemaking workshops and activities were held over a six-month period. The ultimate aim of the research is to develop guidelines for applying place led experimentation locally. This presentation will provide insight into some of the key learning outcomes emerging from this first case study.

TRACtion – Tradition in Action

Dr Zoi Arvanitidou | *Co-researcher:* **Dr Lorraine Portelli**

Department of Health, Physical Education & Consumer Studies, Faculty of Education

Keeping traditional costumes alive through education creates awareness and enhances creativity. It enables students to expand on the knowledge acquired and broaden their career opportunities within the creative industry. The project TRACtion intends to stimulate young people to become aware of and appreciate their garment heritage and recreate it according to their contemporary aesthetic preferences. It will revive, innovate and digitalise three traditional European costumes and simultaneously educate participants on their historical, creative, cultural, environmental, and economic aspects.

The University of Malta, the University of Helsinki, and St. Angela's College, Sligo, Ireland, are higher education institutions, all well-equipped with particular departments that already deliver modules/study units to students opting for an education in fashion and textiles. Currently, no projects revive traditional European costumes within an interdisciplinary context and with the scope of expanding employment possibilities for those who study in this area.

Through TRACtion, students at different levels will gain insights into these traditional costumes. They will be encouraged to apply the lateral thinking, creative skills, and tools necessary for innovative creations. The project will also safeguard these traditional costumes and crafts by promoting the cultural heritage of these three countries through publications, interactive/online workshops, competition, online and on-site exhibitions.

The project will reach students and academics from different institutions, professionals such as artists, fashion designers, educators, historians, costume historians, anthropologists, entrepreneurs, media, and the general public of different backgrounds and ethnicities.

University Academic Lectureship Pathways

Dr Maria Cutajar
Department of Arts, Open Communities, & Adult Education, Faculty of Education

A research study is currently underway exploring academics' pathways. The study is part of an international research collaboration bringing together researchers from Tallinn University, University of Tampere, and University of Malta. The project is partly funded by Tallinn University, and builds on the research work carried out by Tallinn University researchers who are leading the project. The research collaboration aims to achieve a comparative portrayal of university lecturers' academic pathways and their experiences of change in their university work contexts. At the University of Malta, the work expands on earlier research carried out by one of the local team of researchers that investigated variation in the use of digital technologies for teaching among University of Malta academics.

Locally, the research consists of a qualitative study pursuing a deductive thematic description of the academic experience. The local thematic descriptions are based on 10 semi-structured interviews carried out in early 2023 with consenting academics. Building in reliability and preserving the validity and integrity of the research is an ongoing and time-consuming effort, however it is also a means for deepened research engagement, researchers' relations, and significantly the appresentation of the academic pathways.

The local thematic descriptions seek to build further understanding of academic development support, helping academics themselves realise a more fulfilling academic pathway as they navigate the ever-changing context and situations of academic practices. The comparative analysis across three European universities will potentially serve to inform future policies for improving the academic lecturer career to be a more fulfilling one, supported and respected.

Understanding the Applicability of the Timed Cities Concept to the Maltese Context

Dr Sarah Scheiber | *Co-researchers:* **Dr Therese Bajada**; **Dr Wendy Jo Mifsud**
Department of Spatial Planning & Infrastructure, Faculty for the Built Environment

With the ever-increasing interest in the Timed City concept and active mobility related initiatives that emerged during the Covid-19 pandemic, several cities in the developed Western world have engaged in projects to move towards sustainable mobility. Malta is a car dependent Small Island State with the highest population density in the European Union. The archipelago's urban environment and demographics provide an ideal context for implementing the Timed City concept. Context is a very important component when dealing with chrono-urbanism, especially when dealing with hyper-local spaces such as in Malta. Apart from the need for suitable project management, the micro-geography, together with the socio-demographic element of towns can impact whether the Timed City concept is successful. Paola, a dense urban locality in Malta, was thus chosen to evaluate whether the Timed City concept is actionable in principle, prior to embarking on a plan for its potential implementation. Through this research, we collected relevant datasets such as demography, mobility and land use, which were then mapped on a GIS using ArcGIS Desktop 10.8. This method of data gathering and analysis was inspired by the work of Gaglione et al. (2021). We conclude that the data available is promising and that their values indicate that the Timed Cities concept could be successfully adapted to such urban contexts.

The Entrepreneurial Environment Framework

Prof. Russell Smith

Centre for Entrepreneurship & Business Incubation

The "Entrepreneurial Ecosystem" (EE) research field has developed rapidly over the last decade although academics have yet to establish a common frame of reference. In 2021, the "Startup Genome" report identified Silicon Valley, New York and London as the top ecosystems globally. These ecosystems were rated by a number of factors including Total Early- Stage Funding, Median Seed Round Funding and Average Software Engineer Salary. For this latter category in Silicon Valley, the average was $119k as compared to a global average of $46k. Such comparisons are useful for established ecosystems with a focus on equity-financed technology-based companies but have less utility in smaller environments such as islands and small states. Our objective was to create a new way of assessing the environment surrounding enterprise activity that would have utility in any territory and prove useful for new business Founders as well as policy-makers alike.

We developed a 25-component "Environment Framework" that looks at the critical components within it that are needed to support enterprise success (rather than looking at the financial performance of enterprises within the environment) coupled with an assessment methodology. The categories include: Regional Enterprise Policy; Policy Instruments; Professional Advisers; Financial Services; Progress Pathway for Enterprises; Expert Advice; Goods and Services; Research and Development and Enterprise Activity. This Environment Framework offers a practical tool for the assessment of support systems surrounding new enterprises. As such, this new approach offers utility for ongoing academic research and also for policy makers to target and strengthen areas of potential weakness.

Beyond Pandemics: Improving Climate Resilience and Health Systems in Small Islands

Dr Stefano Moncada

Islands & Small States Institute

Small islands are often disproportionately impacted by external shocks and the manner in which they build resilience is increasingly important in the face of climate change and health crises. This presentation discusses the results of a systematic literature review that set out to examine which resilience-building measures are adopted by small Islands to overcome the incidence of two shocks happening simultaneously: climate change and covid-19. While 16,369 studies fulfilled the criterion of jointly assessing pandemic, health and climate, only 662 of these mentioned small islands. In turn, 97 studies fulfilled the additional criteria namely "the pandemic as a driver", "impacts of health or climate shocks", "evidence-based" and "context of small islands". Within these, we examined whether a planetary health approach which recognises the links between environment and health systems was adopted.

The results show that in small islands, and for such shocks in tandem, a planetary health approach is scarcely considered. However specific actions to strengthen resilience were documented to have been effective when facing climate and health crises, which we categorised as: i. the management of short-term risks; ii. the role of non-governmental actors, including self-reliance; iii. the role of local government support; and iv. the role of long-term strategic planning.

This ongoing project identifies climate and public health risks, and resilience-building measures in small islands, which are increasingly challenged by limited financial capacity and infrastructure, long supply chains, and looming climate change scenarios. A mixed-methodology employing systematic literature review, focus groups, household surveys and econometric analysis is used.

Tourism in European Cities: The Visitor Experience of Architecture, Urban Spaces and City Attractions

Dr John Ebejer

Institute for Tourism, Travel & Culture

At the research expo, I will briefly talk about research that I present in the book *Tourism in European Cities: The Visitor Experience of Architecture, Urban Spaces and City Attractions*, of which I am the sole author. The book is based on an extensive desk study of about three hundred academic sources, mostly from tourism studies and urban geography literature. The study was carried out in a structured manner with three main headings namely (i) tourism experience of urban spaces (ii) city resources for tourism and (iii) tourism and the built environment. The main findings of the research were as follows: There is keen competition in tourism with hundreds of cities and regions across Europe working hard to attract the tourist euro. Many cities have invested heavily to make themselves more attractive as visitor destinations. They invested in the remodelling and enhancement of their main public spaces and also in transport infrastructure including public transport. Some cities chose to enhance their attractiveness by creating iconic architecture and urban spaces. In my presentation I will briefly highlight these and other points that emerged from the study.

Barriers to Staff Attendance at the Basics in Medical Education (BiME) Course Organised by the Faculty of Medicine and Surgery, University of Malta: A Case Study Approach

Dr Petramay Attard Cortis

Department of Surgery, Faculty of Medicine & Surgery

The Basics in Medical Education (BiME) course aims to promote faculty development within the Faculty of Medicine and Surgery, University of Malta. Despite being offered free of charge the turnout has been underwhelming. This research aimed to identify barriers to staff attendance. A qualitative, explanatory, single-case study was performed in 2020 after obtaining Ethics Committee permission. Data was collected via semi-structured interviews with faculty members who self-selected to participate after receiving an invitation email; and through documentation analysis of anonymised participant feedback forms collected from previous iterations of the course held in 2018 and 2019. Data analysis was performed using Pattern Matching. Individual and institutional barriers to attendance were identified. The main barrier was an individual's personal characteristics, particularly a lack of appreciation of the importance of faculty development. Other barriers included a lack of time; a reduced awareness of the concept of separate professional and educator identities; a lack of information about the course; a feeling of isolation from the faculty community; and a possible insufficiency of institutional governance and recognition. Funding, and the interprofessional aspect of the course, were found not to be barriers to attendance. An understanding of the specific barriers to attendance at the BiME course may allow the Faculty to mitigate these, encouraging staff attendance, and thus promote faculty development in medical education at the University of Malta.

Expo Stream ES1.2

Life Sciences and Medicine

CHAIR: **Prof. Richard Muscat**

The Thalassemia Project; Quantitative Epidemiology of Human Haemoglobin and the Pathophysiology of Developmental Globin Gene Control

Prof. Alex Felice | *Co-researchers:* **Prof. Christian Scerri**; **Prof. Joseph Borg**; **Ms Ruth Galdies**
Department of Surgery, Faculty of Medicine & Surgery

The replacement of the adult β globin by the foetal γ globin could treat most types of Thalassaemia Major. Thalassaemia is a severe rare haematological disorder with high health impact due to the high demands for blood transfusion and health care. It is caused by mutations at the β globin gene that suppressed the biosynthesis of the β globin in erythroblasts.

We addressed the question with a combination of family and population studies leading to inferences in the experimental genetics laboratory. The finding of the Hb F Malta I variant in tight linkage disequilibrium with the β globin variant Hb Valletta yielded quantitative biomarkers of globin gene expression and the in vivo quantification of the defect in the common β + IVS-I, 6C thalassaemia of Malta. Although relatively mild (33% MCH) the homozygote children needed as much blood transfusion as those with more severe mutations and responded poorly to HydroxyUrea, a known inducer of post-natal HbF. We surmised that inflammation in the bone marrow inhibited the Hb F response and sought extensive exploration of protein and mRNA profiles. Other families presented with persistent post-natal Hb F and deletions of the KLF1 gene. Wider studies indicated that KLF1 could be considered a master regulator of erythropoiesis and with very strong promoters and several sequence variants.

Based on the above we are seeking for genetic modifiers with which to suppress KLF1 sufficiently to sustain adequate post-natal Hb F without impairment of other KLF1 dependent pathways.

Reduction in Size of a Novel Hip Joint Replacement: A Numerical Study

Dr Leonardo Fanton
Department of Metallurgy & Materials Engineering, Faculty of Engineering

The wear of polyethylene components is an important factor limiting the lifespan of hip joint replacements since the generated debris can trigger inflammatory responses which eventually may lead to aseptic loosening. A novel hip joint replacement designed to reduce wear is composed of four components and three metal-on-polyethylene unidirectional articulations. The first prototype of this implant, created with a medium-size acetabular cup of 53 mm external diameter, showed a significant reduction in wear compared to the conventional ball-and-socket design. This was demonstrated by experimental hip joint simulation tests. The current study aims to expand the implant size range to increase its commercial viability, ensuring the safety of polymeric components with reduced sizes. A smaller version of the implant with an acetabular cup of 46 mm diameter was designed. Finite Element Analysis (FEA) was used to calculate the equivalent stresses and contact pressures during a gait cycle. Transient analyses were used with boundary conditions configured according to the standard gait cycle defined in the standard BS ISO 14242–1:2014: Implants for surgery – Wear of total hip-joint prostheses. The non-linear mechanical properties of the polyethylene components were simulated using the Three-Network Model. The maximum equivalent stress in the polymeric components was 12 MPa, and the maximum contact pressure on the metal-on-polyethylene articulations was about 23 MPa. These results show relatively similar stress levels compared to the medium-sized (53 mm) implant, indicating that an implant of this size would present comparable wear results.

Translational Stroke Research

Prof. Mario Valentino

Department of Physiology & Biochemistry, Faculty of Medicine & Surgery

Our research aims to comprehend the cellular mechanisms underlying neurological disorders such as stroke, with the goal of identifying emerging concepts that can drive our findings towards therapeutic advancements. Once considered exclusively a disorder of blood vessels, growing evidence has led to the realisation that the biological processes underlying stroke are driven by the interaction of neurons, glia, vascular cells and matrix components, which actively participate in mechanisms of tissue injury and repair.

Our research is complemented by the use of cell-specific fluorescent proteins that can be incorporated by genetic fusion to produce a fluorescent label in transgenic mice and use them as reporters in brain pathology. We then take advantage by applying in vivo two-photon laser scanning microscopy to capture instantaneous and highly resolved cellular and molecular events within the brain that occur during and following a stroke. Knowledge of the intricate dynamics and cross-talk helps us to better understand what causes these cells to die and how they could be made to recover.

We also take advantage of advanced laser optical techniques to induce and image single-vessel or large-scale occlusions as a means to provide a more comprehensive non-invasive model of a stroke. Notable amongst our achievements is the work published in Nature Communications in 2018, of the surprising role of glutamate in myelinic NMDA receptor activation and the development of the first drug capable of elevating the injury tolerance to the whole brain. This study represents a step-change in both our understanding of myelin pathology and our ability to prevent it.

Harnessing Phage Display Technology for Accelerated Antiviral Therapeutics Discovery

Ms Giuseppina Monda

Department of Applied Biomedical Science, Faculty of Health Sciences

The COVID-19 pandemic and recent outbreaks of other highly virulent viruses have severely threatened global health and economies, highlighting the need for effective and rapid antiviral therapeutics discovery. A promising strategy is to develop neutralising antibodies that block the interaction of viral surface proteins with human host cell receptors.

The ACCELERATE project aims to rapidly discover and validate recombinant, high-affinity, neutralising antibodies against SARS-CoV-2 and ZIKV viral envelope proteins using phage display methodology. Phage display is a Nobel prize-winning technique that utilises genetically modified bacteriophages to display foreign peptides or antibodies on their surface. Phage display libraries can contain up to billions of different clones, each displaying a unique peptide or antibody. Thus, this technology enables the rapid and high-throughput screening of antibodies against a specific target entirely in-vitro without the need for animal immunisation.

By screening a phage display library, we have already identified and validated high affinity and high specificity recombinant antibodies targeting SARS-CoV-2 and ZIKV viral envelope proteins. These recombinant antibodies will be assessed for their neutralising potential on the viral protein/human receptor interaction using human cell-based in-vitro assays.

Our group has developed the first platform in Malta that uses the strengths and versatility of the Phage Display system. Through our research, we aim to contribute to the development of a powerful tool that can be employed by researchers in Malta in a variety of application fields.

Bioinformatics for Multi-omics (BioGeMT)

Dr Panagiotis Alexiou
Department of Applied Biomedical Science, Faculty of Health Sciences

BioGeMT is a project that focuses on bioinformatics for multi-omics, with the aim of developing innovative methods and tools for analysis of multiple streams of –omics data for the understanding of disease as well as prognosis and drug discovery in the context of biomedical research.

The BioGeMT project is led by an ERA Chair as a team leader. The Bioinformatics Team (BT) conducts analysis, shares pipelines and tools, and offers services to research groups at the University of Malta and beyond. The BT also offers support for grant and publication writing, and contributes to the development of ethical frameworks for high-throughput sequencing (HTS) in a Multi-Omic era.

The BioGeMT project aims to consolidate HTS data storage, facilitate data sharing, and promote international collaborations, thereby enhancing research outputs and increasing safety and efficiency. The project offers opportunities for industry and UM research integration through meetings and collaborations, revenue generating courses, and the integration of machine learning with biological data analysis.

Overall, the BioGeMT project aims to enhance synergies with other areas of research at UM and beyond, contributing to the advancement of bioinformatics for multi-omics and improving health outcomes through preventive, personalised, and precise medicine.

Tuning in and out: A Brain Electrical Routing Mechanism During Working Memory

Dr Nowell Zammit
Centre for Molecular Medicine & Biobanking

If the trillions of connections arising from the billions of neurons in the brain may sound chaotic, yet then chaos, as was once argued, 'offers something to be genius about'. To date, current neuroscience research is making an attempt to understand the various mechanisms the brain employs to route activity selectively from one area to another such as that proposed by the "Communication by Coherence '' hypothesis. Consequently, neurons appear to modulate their electrical rhythmicity to tune in or out with the various other neurons located in distinct brain regions. In this study, we focus on alpha and beta rhythmic oscillations to investigate specific mechanisms activated during working memory where the phase of slower brain rhythms is modulated to couple, or in turn, decouple, with the other rhythms evoked at higher frequencies such as gamma. We address the latter through the use of human EEG conducted in healthy controls and ADHD subjects. The results thus far have revealed working memory-specific rhythmic 'Phase amplitude decoupling (PAC) signatures' and their impairment in ADHD with a corresponding regulation by specific cortical neurocircuits that utilise the catecholamines such dopamine and noradrenaline. Decreased alpha/beta-gamma coupling is likely to facilitate memory representations via disinhibition of gamma ensembles coding the stored sensory stimuli. The EEG evidence presented herein goes a step further in that it suggests, in addition to the well-known link between beta oscillations and WM function, the dysfunction of which as represented by the inability to decouple, may arise through abnormal catecholaminergic neurotransmission within the circuits of the cortex.

Brain White Matter Injury: Pathophysiology and Future Therapeutic Targets

Dr Christian Zammit

Department of Anatomy, Faculty of Medicine & Surgery

The white matter in the brain is a target of hypoxic-ischemic injury throughout life. In clinical settings this ranges from periventricular leukomalacia in neonates, stroke in adults, to dementia in the ageing brain. The burden of these disorders has serious consequences on the quality of life as these lead to significant motor, sensory and cognitive impairment. Our group focuses on the pathophysiological mechanisms that occur in white matter following common insults such as ischaemia and hypoglycaemia. Experimental approaches include in vivo optic nerve and acute corpus callosum brain slice models employing electrophysiological, immunocytochemical and advanced optical microscopy techniques. Our experimental approach takes advantage of transgenic mice with cell-specific expression of fluorescent proteins that allow us to trace the form and function of the cellular elements to identify intercellular signalling mechanisms involved in cell death and test for new drug therapies to promote recovery.

Periventricular leukomalacia is a relatively common type of brain injury especially in premature infants, that commonly leads to motor and cognitive impairments, cerebral palsy and behavioural problems. We have previously shown an elevated susceptibility of early maturing nerve fibres to ischaemic injury, which places them alongside pre-oligodendrocytes as the primary targets towards pharmacological therapy.

Although hypoglycaemic brain injury is a milder form of insult, it also has the potential to cause irreversible injury to the human brain. In separate studies we showed how specific blocks of glutamate receptors and stimulation of the noradrenergic system during aglycaemia significantly preserved axonal structure and function.

Predicting Explainable Drug-Drug Interactions Using Knowledge Graphs

Ms Lizzy Farrugia | *Co-researchers:* **Dr Jeremy Debattista**; **Prof. Lilian Azzopardi**; **Dr Charlie Abela**

Department of Artificial Intelligence, Faculty of Information & Communication Technology

Drug-drug interactions (DDIs) are a significant contributor to adverse drug reactions (ADRs), which can lead to escalating healthcare costs and mortality rates. The concomitant use of multiple drugs by patients can result in negative DDIs, causing adverse side effects. The need for multi-drug treatments has increased, making the identification of DDIs a crucial task. Nevertheless, detecting DDIs among a large scale of drug pairs both in vitro and in vivo is time-consuming, labour-intensive, and expensive.

As a solution, computational approaches have been developed to predict potential DDIs. Knowledge Graphs (KGs) have attracted considerable attention in the drug domain since Google introduced its KG in 2012. Biomedical KGs are capable of capturing the relationships between entities such as drugs, indications, and side effects. Our aim is to construct a biomedical KG from public repositories and focus on identifying missing DDI relationships. Identifying relationships within a KG is commonly referred to as Link Prediction (LP). Our approach will leverage a Graph auto-encoder that first embeds nodes in the graph using Graph Neural Networks (GNNs), which have demonstrated superior ability in mining the underlying semantics of KGs, and then learns to distinguish between interacting and non-interacting drug-pairs to predict unknown DDIs.

Despite the promising results that GNNs have shown in the DDI domain, they are considered "black box" models, necessitating the provision of explanations to healthcare professionals to bolster their trust in the model's predictions. Current research has focused mostly on GNNs' explainability for node and graph classification tasks. In our work, we aim to extend well-established explainability algorithms such as GNNExplainer to provide explanations for our link prediction model.

Expo Stream ES1.3

Life Sciences and Medicine

CHAIR: **Prof. Josanne Vassallo**

Detection of an Immune Cell Population With Both Lymphocytic and Monocytic Characteristics In Pituitary Tumours

Dr Oriana Mazzitelli

Department of Applied Biomedical Science, Faculty of Health Sciences

Pituitary Neuroendocrine tumours or PitNETs originate in the pituitary gland in the brain, and although usually they do not metastasise, they can cause visual impairment by pressing on the optic nerve or cause dysregulation of hormone secretion. PitNETs are classified into functional if they secrete hormones e.g. Growth Hormone Pituitary Adenomas (GHPA) or non-functional pituitary adenomas (NFPA) if they do not.

The aim of MPitNET project is to study and map the immune microenvironment in PitNETs, the knowledge of which is still lacking, yet is essential to develop novel cancer immunotherapies which have revolutionised treatment options by offering several advantages over other therapies.

The objectives are hence to identify the immune cells infiltrating PitNETs, their abundances, functions and locations in the tumour samples. The team has so far managed to develop a novel method to extract pituitary and immune cells from fresh NFPA and GHPA tissue obtained from transsphenoidal surgeries performed locally. The cell suspensions obtained were then analysed by flow cytometry using a panel of antibodies to characterise and quantify the different types of immune cells present, including rare cell populations. Results show that all tumour samples analysed had different types of immune cell infiltrates both from the lymphocytic as well as myeloid (macrophage) lineage. Yet the most interesting observation made was that a new population of cells was potentially unravelled having phenotypic characteristics of both cytotoxic T lymphocytes and monocytes. Such cells have never been reported in such context and we are validating our current findings as well as trying to determine the function and location of these cells in PitNETs using other technologies and international collaborations.

Electromagnetic Hyperthermia for Breast Cancer

Dr Lourdes Farrugia

Department of Physics, Faculty of Science

In microwave hyperthermia (MH) cancer treatment application, antenna arrays selectively heat cancerous cells to a supra-physiological temperature. The administered heating relies on finding the antenna feeds that maximise the specific absorption rate (SAR) inside the tumour. In this study, we investigate the performance of grouping the phase or amplitude of vertically aligned antenna elements, using 2D PSO optimisation. The numerical MH system includes a three-dimensional MRI breast model and a connected array as the MH applicator. The structure of the array is curved and it consists of 3 layers and 39 elements (3×13), which are capacitively coupled fractal octagonal rings (FORA). The results show that the phase parameters need to be individually optimised for superior focusing. The amplitude grouping demonstrates a performance comparable to the individual parameter optimisation. To conclude, using the sub-arrays approach in relation to the amplitude of the antenna array can significantly decrease the number of freedom in the system and the RF background cost, without compromising on performance.

Assessing the Differential Gene Expression Profiles in Human Growth-Hormone (GH) Secreting and Non-functioning (NF) Pituitary Tumours Using Transcriptomic Analysis

Ms Emma Jayne Spiteri

Department of Applied Biomedical Science, Faculty of Health Sciences

Pituitary neuroendocrine tumours (PitNETs) are defined as intracranial, endocrine neoplasms commonly arising in the sella turcica at the base of the brain. Current research on these tumours has shed light on the fact that molecular strategies developed by the tumour microenvironment could influence the efficacy and efficiency of the patient's immune system. These strategies involve a change in the expression of specific genes between the PitNET and healthy pituitary tissue, as well as between different PitNET subtypes themselves.

Despite the advancements in research, the identity, expression and function of these genes within PitNETs is still widely unknown, especially for immune-functioning genes. Therefore, the MPitNET project aims at further understanding how immune gene expression differs between two common PitNET subtypes: growth-hormone secreting PitNETs and non-functioning PitNETs through the employment of RNA-sequencing technology.

Through our findings, we have uncovered distinct gene profiles in the two PitNET subtypes comprised of 7945 genes. 27 immune-functioning genes were then selected via online databases from which 6 genes were chosen for further validation via qRT-PCR. Furthermore, functional analysis was also performed which highlighted specific pathways having potential impact on PitNET maintenance.

Our findings have contributed towards bridging the knowledge gap of the immune environment in PitNETs with findings that, in the long run, could be relevant to other non-endocrine neoplasias. Furthermore, through the usage of further technologies and international collaborations, we attempt to gather more information about the potential function of these immune-related genes within the PitNET microenvironment.

Project PADLOCK: Discovering Novel Antibodies Targeting Multiple Immune Checkpoints for Enhanced Cancer Immunotherapy

Prof. David George Saliba

Department of Applied Biomedical Science, Faculty of Health Sciences

Immune checkpoint proteins play a crucial role in regulating the immune response and preventing the immune system from attacking healthy tissues. However, they can also be exploited by cancer cells to evade surveillance and elimination by immune cells. Targeting these checkpoints with immunotherapies has revolutionised treatment options for a variety of cancers. Defined as immune checkpoint inhibitors (ICIs) these antibody-based therapeutics have emerged as clinically successful anti-tumour pharmaceuticals. Currently commercially available antibodies target only two of the sixteen immune checkpoints.

Project PADLOCK is centred on discovering novel antibodies that specifically target a panel of immune checkpoints. We have set up a Phage Display technology platform – a first for Malta. This technology has unparalleled benefits including fast lead times, flexibility to tailor antibody properties and not requiring animal use.

We optimised a novel method to capture the immune checkpoints on superparamagnetic spherical polymer nanospheres thereby facilitating the identification of specific antibodies following phage display biopanning. This biopanning technique efficiently isolated antibodies from a phage display library of a billion candidates.

We then validated a collection of antibodies that specifically bind our target by ELISA technique. Using Sanger and Nanopore sequencing we determined the full sequence of the candidate antibodies.

These candidate antibodies are of crucial importance as it expands our ability to address current and future challenges in clinical oncology research.

Using Fruit Flies to Gain Insights Into the Neuromuscular Complications of COVID-19

Dr Paul Herrera

Department of Physiology & Biochemistry, Faculty of Medicine & Surgery

SARS-CoV-2, responsible for COVID-19, wreaked havoc worldwide when it started infecting humans. The major target of this coronavirus is the respiratory system, and it manages to enter host cells by using its spike protein to latch onto the cellular receptor known as ACE2. The virus reaches the lungs after entry through the nose or mouth, and this is the primary site of injury. In the worst case it can lead to respiratory failure. However, the neuromuscular system also appears to be affected in a large percentage of COVID-19 patients, especially in those suffering from 'long COVID'. Symptoms include muscle weakness, fatigue and exercise intolerance. The cause of such neuromuscular manifestations remains unresolved. They may result from direct viral injury or may be the consequence of ACE2 gene inactivation. ACE2 has been highly conserved throughout evolution and this facilitates the use of model organisms to investigate the probable cause of the COVID-19 neuromuscular complications. We made use of the fruit fly (Drosophila) model for this purpose. Flies can respond rapidly to stimulation as well as perform complex motor behaviours by virtue of their sophisticated neuromuscular system, albeit being simpler relative to humans. Using a mixture of laboratory techniques, we demonstrate that knocking down this conserved gene in the fruit fly produces motoric deficits including reduced locomotion and impaired flight capacity. RNA sequencing also identified several affected genes required for proper synaptic function. Our results begin to shed some light on how COVID-19 related neuromuscular complications are brought about after SARS-CoV-2 infection.

Maltese Algae for Health Food

Prof. Gabrielle Zammit

Department of Biology, Faculty of Science

The algal biodiversity of the Maltese islands is currently being studied via an innovative multiphasic approach that includes morphological, genetic and chemical analysis. Our studies have so far revealed widespread cryptic diversity that warrants further investigation of evasive algae. New genera and species of algae have been described and their novel products are being chemically characterised. This project involves the proper identification, sustainable growth and analysis of suitable algal candidates for application in the food industry, thus contributing to Malta's bioeconomy.

Ecological Niche Modelling for Arthropod Habitats in the Circum-Sicilian Islands

Dr James Ciarlo
Institute of Earth Systems

Arthropods (insects, spiders, centipedes, etc.) play a vital role in ecosystems, and hence are excellent indicators of ecosystem integrity. Anthropogenic processes (such as climate change and land-use change) are substantially contributing towards the loss of this ecosystem integrity. The multidisciplinary PALEOSIM project (PALEOclimate modelling of Small Islands in the Mediterranean and possible impacts on arthropod habitats) aims to shed light on the processes (natural and anthropogenic) that contributed to the ecological changes of small islands such as the Circum-Sicilian islands (Malta, Gozo, Lampedusa, Pantelleria, Lipari, etc.) in the central Mediterranean.

Currently, the study is focused on the use of environmental parameters (air temperature, rainfall, wind speed, etc) to establish an ecological index and describe the potential habitat range for a selection of arthropods. This can be applied to existing Regional Climate Model data from the CORDEX (COordinated Regional climate Downscaling Experiment) dataset, as well as new 3 km simulations of these islands. The new simulations are made using the RegCM5 driven by CMIP6 (Coupled Model Intercomparison Project Phase 6) simulations of multiple scenarios (ranging from paleoclimate to future).

Two Decades of Specialist Nurses in Malta

Dr Corinne Scicluna
Department of Nursing, Faculty of Health Sciences

The demand for highly skilled nursing professionals has become increasingly apparent globally, particularly in the wake of the COVID-19 pandemic. In recent years, nurses have been entrusted with greater responsibilities and expanded roles. However, little attention has been paid to nursing professionals' work sector and management practices. Additionally, there is a dearth of information in the literature regarding the exact nature of their roles, extended roles, or the implementation of innovative training and research-based approaches. In this review, we comprehensively discuss the roles of specialist nurses in Malta. As a small European island, Malta's nursing profession is still influenced by past cultural and ideological beliefs, which can affect how it is perceived. This review also examines various aspects of specialist nursing, including their roles, challenges in their development, and potential solutions to these issues. Furthermore, we compare the current situation in Malta to documented scenarios in other countries and the relationship of the nurses with stakeholders, providing a comparative analysis.

Expo Stream ES1.4

Architecture and STEM

CHAIR: **Prof. Inġ. Andrew Sammut**

Design and Stress Analysis of Fusion Reactor Systems

Prof. Inġ. Pierluigi Mollicone

Department of Mechanical Engineering, Faculty of Engineering

UM is part of the EURofusion consortium, through the national MCST 'Research and Development towards a European Fusion Reactor' (ENDURE) programme. The research group at the Department of Mechanical Engineering contributes in the field of stress analysis and structural integrity as part of DEMO, the DEMOnstration power plant, successor of ITER. DEMO is a technology-driven programme where the key criterion is the production of electricity, to lay the foundation for the environmentally sustainable power plants of the future.

In this work, two systems are analysed: the Breeding Blanket (BB) transporter with its transfer cask and the Central Solenoid (CS) pre-compression assembly. In both cases a series of preliminary elastic structural analyses are presented, which follow, where applicable, relevant design codes. For the BB transporter load cases consider dead weight, handling of BB segments and seismic events. A complex setup of sub-assemblies is included in the model. For the CS pre-compression system, the key stages of loading and inducing an initial pre-compression in the CS winding pack are analysed. The aim of both studies is to assess initial concept feasibility.

The analyses are performed with Finite Element Analysis (FEA) using advanced modelling techniques. Results are used for design improvements and for a quantification of key parameters, such as reactions on bearing rollers, forces in the lifting chains and main stresses of key components. Current results generally show that the design concepts are feasible with only a few component dimension modifications required to meet the set criteria.

Creep Fatigue Assessment of DEMO Fusion Reactor Divertor Components

Prof. Inġ. Martin Muscat

Department of Mechanical Engineering, Faculty of Engineering

The divertor is one of the main in vessel components having Plasma Facing Components. The plasma is contained in a nominal D-shaped cross section shaped torus by the strong magnetic fields created by the toroidal and poloidal magnets which lie outside the tokamak vacuum vessel. The malfunction of a magnet, a failure of the control system and the presence of impurities can trigger a plasma disruption so that the latter moves away from its confined designed position. In a fusion power plant such disruptions can severely damage parts of the reactor especially the first wall and divertor. The damage is mainly caused by the high temperatures seen by the components and the large currents going through them. Apart from handling disruption events one of the main functions of the DEMO divertor is to deal with the constant loss of particles and energy from the plasma. These hit the target plates where they deposit their energy. This energy is removed as thermal energy by cooling fluid passing through the target components. The plasma core continuously radiates fast neutrons that generate volumetric nuclear heating in the divertor components. The divertor is therefore subjected to high temperatures, fluctuating mechanical loads and to neutron irradiation that can cause creep and creep fatigue failure to take place. UM is involved in developing methodologies of design and analysis following the French nuclear reactor design code of standard RCC-MRx in order to prevent the structural failure of the divertor components under such extreme loading conditions.

User Requirements for Sustainable and Smart Packaging

Ms Tamasine Camilleri

Department of Industrial & Manufacturing Engineering, Faculty of Engineering

Packaging aims at protecting products during transportation, to ensure that it reaches the end-user safely. Smart packaging has additional functions to further facilitate this process, by providing means of communication, hygiene, and traceability. Smart packaging is typically used for consumable products, such as foods and pharmaceuticals. However, even if the smart packaging successfully protects the product, this does not guarantee that it provides users a good experience when handling the packaging. Furthermore, it is evident that packaging has adverse impacts on the environment throughout its life cycle. Environmental and ethical concerns are also becoming increasingly important in consumers' product choices. Sustainable design therefore ensures that the packaging's negative impacts are feasibly minimised, and in so doing also give due importance to social considerations. In this context, this paper aims to explore sustainability and user experience in smart food and pharmaceutical packaging. Two focus groups, with eight participants each, were conducted to identify the necessary stakeholder requirements for sustainable and smart packaging in the food and pharmaceutical sectors. The participants in this study represent stakeholders throughout the lifecycle of packaging, from design, manufacturing, supply chain management, and end-use. Findings from this research can contribute to developing a design support system to guide packaging designers to adopt a user-centred approach in the design of sustainable smart packaging.

Coordinated Energy Storage for Low Carbon Power Networks

Dr Somesh Bhattacharya

Department of Industrial Electrical Power Conversion, Faculty of Engineering

In response to the potential extreme effects of climate change, several countries across the globe have committed to stringent decarbonisation targets. Increased use of renewable energy and electrification are the main elements of the prevalent approach preferred globally towards achieving the targets. The consequent shift from the traditional power network operation has introduced significant challenges to the utility operators. The project investigates the use of utility-scale energy storage systems (ESS) to facilitate the transition to low carbon power networks. Spurred by the flexibility which can be offered by ESS but acknowledging the present barriers to widespread deployment of utility-scale ESS, the project considers the optimal sizing and placement of ESS on medium and low voltage power networks. The objectives are to overcome the technical challenges introduced by the major players enabling the energy transition and to open potential value streams to improve the financial aspects. COSTORE will evaluate envisaged low-carbon scenarios through power hardware in the loop (PHIL) simulations on a real-time simulator utilising laboratory-scale lithium battery ESS technology.

Using Nature's Resources to Make Composites More Sustainable

Dr Brian Ellul Grech

Department of Mechanical Engineering, Faculty of Engineering

Composites are widely used because their characteristic material properties can be tailored to the demanding needs of today's technology. Composites are employed in different sectors such as maritime and aerospace applications, pressure vessels, automobile applications, surfboards and electricity distribution systems amongst others. Synthetic reinforcements are currently widely used in composites but these are not environmentally sustainable due to toxic by-products generated during their production and non-degradable properties. Given the heightened environmental impact awareness, research into natural fibre reinforcements experienced a considerable impetus during the past two decades. Natural fibres are harvested from plants and crops so they have inherently different lengths, cross sectional areas and structural defects that affect the fibres' mechanical properties. In addition, the extraction processes such as pressing, rolling, machine decortication or biological retting also have an effect on the composite's mechanical properties.

This project presents an opportunity to use fibres from locally grown agave plants turn them into fibre products that can be used to produce components made out of natural fibre and bio-based resin. In particular, a study on the interface between the agave fibres and epoxy matrix has been carried out to set forward the best practices to prepare the natural fibres for the production of composites. In addition, agave fibre processing and resin infusion tests are being carried out to establish the best practices to create coupons for future material characterisation tests. Upon establishing the mechanical properties, numerical simulations will be carried out to design components using the novel bio-composites.

Surface Engineering of Metallic Orthopaedic Alloys Using Commercial Treatments

Dr Antonino Mazzonello

Department of Metallurgy & Materials Engineering, Faculty of Engineering

Tribocorrosion processes in metal-on-metal (MoM) total hip replacement implants generate fine debris and metal ions. To improve the corrosion-wear performance of MoM implants, in this work a low-carbon wrought ASTM F1537 CoCrMo alloy and a low-carbon cast StelliteTM 21 alloy were surface engineered using commercially-available treatments, namely low temperature carburising, and a high-power impulse magnetron sputtered Cr2N coating. Such treatments were applied to limit oxidation-related losses and suppress coating-substrate interface corrosion leading to coating blistering.

A reciprocating tribocorrosion machine was used to slide wrought CoCrMo discs against wrought CoCrMo and cast StelliteTM 21 CoCrMo counterface test pieces. A novel testing configuration was employed whereby both the disc and counterface materials ("tribopair") were metallic and surface engineered to better replicate the MoM implant conditions. Electrochemical measurements, in conjunction with advanced characterisation techniques, were used to assess the corrosion-wear performance.

The untreated Wrought-Cast (W-C) tribopairs exhibited superior corrosion-wear performance with lower dynamic anodic currents, coefficient of friction (CoF), and total material losses, compared to the untreated Wrought-Wrought tribopairs. The improved corrosion-wear behaviour is attributed to an oxidised layer that suppressed oxidation losses on the W-C tribopairs. The Cr2N and Cr2N/Carburised-coated materials successfully mitigated oxidation-related losses when compared to the untreated and carburised tribopairs, and were also resistant to coating-substrate interface corrosion. The inherent chemical inertness of the Cr2N coating resulted in extremely low dynamic anodic currents, metal ion release and CoF. Nano-scratch results and corrosion-wear testing also confirmed that the underlying carburised layer offered an enhanced load-bearing support to the Cr2N coating.

Nanoplastic Fate and Ageing Behaviour

Dr Sophie Briffa

Department of Metallurgy & Materials Engineering, Faculty of Engineering

Plastics are considered a serious ecological concern. After release into the environment, plastics from consumer items can degrade into micro- and nano- plastics. Given their abundance and persistence, human and animal exposure is unavoidable. An understanding of their environmental fate is essential for risk assessment, but their challenging detection complicates this. Novel interdisciplinary research strategies are needed for a more accurate impact assessment, based on realistic and suitably aged nanoplastics. This work is investigating whether environmental ageing of commercially relevant plastics can reveal new knowledge to shed light on ways to reduce nanoplastic pollution. To date, polyethylene terephthalate (PET) pellets were subjected to UV ageing for 90-days in water columns within an ad-hoc weathering chamber to simulate accelerated seawater plastic degradation. Preliminary electron microscopy results show that, after 60 days, minimal levels of micro- and nano- plastics were detected in the water. The pellets showed initial signs of degradation including salt inclusions and cracking. The micro- and nano- plastics generated from the pellets were quantified following detection via UV microscopy after Nile Red staining. Finally, Raman spectroscopy indicated trends for the phenyl and carbonyl PET components as a function of time. Further work will aim to determine degradation trends, model these and use them to predict future behaviour.

High-speed Permanent Magnet Synchronous Machine Design for the Flywheel Energy Storage System Application

Ms Xuewen Lian

Institute of Aerospace Technologies

Energy storage systems play an important role in the transition to net zero transportation carbon emissions. Among all the energy storage types, flywheel energy storage has been found to have a better and balanced performance considering both energy density and the power density, which is advantageous in aviation applications to be charged and discharged quickly in a short time. This research is aimed to design a high-speed permanent magnet synchronous machine (PMSM) for the flywheel energy storage system (FESS). The research takes the landing of an aircraft as a case study, in which the large amount of kinetic energy during aircraft landing is recovered. This energy is stored temporarily in the high-speed composite flywheel and is then used to power the taxiing of the aircraft to the gate. For this purpose, the analytical design of the electrical machine is first conducted. Then finite element analysis (FEA) is applied based on Siemens MagNet software to verify the electromagnetic performance of the analytically designed machine model. Thermal analysis is also included by building a lumped parameter thermal network (LPTN) for the single slot of the stator used in this research to ensure thermal performance when loaded. The geometry of the designed PMSM is optimised by sensitivity analysis to increase the torque density, power density and efficiency for the proposed aviation FESS application. A surface-mounted permanent magnet electrical machine which is reliable in high-speed applications is to be designed as the result of the current study. The combination of the high-speed composite flywheel and the PMSM will also be investigated.

Doctoral Stream DS2.1

Architecture and STEM

CHAIR: **Prof. Emanuel Buttigieg**

Piezoelectric Micro-machined Ultrasonic Transducers Optimised for Intra pore Deployment in Reinforced Concrete Structures

Inġ. Stephen Sammut

Department of Microelectronics & Nanoelectronics, Faculty of Information & Communication Technology

Structural Health Monitoring systems for civil engineering structures are more effective when sensory systems are integrated within the structure itself. Sensors such as those detecting chloride ions if embedded inside the pore solution would be able to effectively detect any chloride ions which are close to the rebar. On the other hand an embedded sensor within a structure needs to be able to communicate with other devices and with the outside environment.

Ultrasonic radiation is a means through which data can be transmitted through an opaque, dense structure such as concrete and therefore ultrasonic transducers are a means which can be utilised for data transmission and reception. Current ultrasonic equipment used in concrete structural health monitoring is based on macroscale equipment and hence not easy to be embedded in the structure in a diffused, cheap and effective way. This project aims to miniaturise ultrasonic transducers to the microscale by the use of Micro Electro Mechanical (MEM) systems and hence various Piezoelectric Micro machined Ultrasonic Transducers (PMUT) were designed, built and tested in liquids such as Isopropanol and Glycerine. Most PMUT devices reviewed in literature have been designed to operate in gaseous fluids such as air. This project therefore looks at the state of the art application of PMUT technology optimised to operate in liquids at frequencies which are ideal for the subsequent transfer of the ultrasonic radiation into the concrete structure.

Towards Sustainable Injection Moulding Using 3D Printed Conformal Cooling Channels: A Comparative Simulation Study

Ms Rebecca Clark

Department of Industrial & Manufacturing Engineering, Faculty of Engineering

In recent years, studies have proven that conformal cooling channels (CCC) in an additively manufactured mould result in a more efficient and effective injection moulding process. This can be achieved since CCCs are designed to follow the contour of the part being moulded so that the surface of the part to be cooled is equidistant from the channel at all points. The CONFORM project aims to design a novel type of CCC, moving away from the traditional circular channels that are still widely used in injection moulding. In order to set a benchmark for circular CCCs and conventional cooling channels, a study is being carried out using the same case study part which will be used in the design of the novel CCCs. At the time of writing, there were no studies which explored the combined effect of the use of CCCs with mould cores additively manufactured entirely out of materials with high thermal conductivities. Within this context, a study is being carried out to explore the effect of the tool material's thermal conductivity on the performance of various CCC designs in comparison with conventional, straight drilled cooling channels. The performance of the cooling channels is analysed from a sustainability point of view by comparing the channel performances in terms of energy consumption, financial implications, and the resulting quality of the part. The results of this study will serve as a benchmark which will be used to compare the performances of the novel CCCs with the traditional CCCs.

Doctoral Stream DS2.2

Architecture and STEM

CHAIR: **Prof. Inġ. Jonathan Borg**

PREMIER: A Research Project on Smart, Emotionally Pleasing Above Knee Prosthesis

Mr Nicholas Patiniott

Department of Industrial & Manufacturing Engineering, Faculty of Engineering

Amputations are becoming increasingly common in today's society, either due to traumatic events such as injuries and wars, or due to diseases such as diabetes and bone infections. Statistically, Lower Limb (LL) amputations are more common than Upper Limb amputations. Consequently, the need for LL prosthetics is on the increase. Our state-of-the-art review indicates that there is a need to develop a smart above knee prosthesis (AKP) that provides a sufficient number of Degrees of Freedom useful for routine activities that is also relatively cheap to realise and emotionally pleasing.

To address this need, research is being conducted as part of what is known as the PREMIER project to develop an AKP that would be custom made to the specific needs of individual amputees. As our research has established, the amputee's needs evolve with time, in particular after having been fitted with their prosthesis. Thus, the PREMIER project is explicitly embedding smart features to enable prosthetists to monitor the health of both the patient and the prosthesis. Relevance to this is that the PREMIER project is simultaneously developing a prescriptive and adaptive Product Service System (PSS) framework to improve the healthcare service provided to amputees through the use of such smart AKP. These emerging results will be outlined during this presentation.

Micro-Electro-Mechanical-System (MEMS) Gripper for Biomedical Applications

Inġ. Thomas Sciberras

Department of Mechanical Engineering, Faculty of Engineering

Microelectromechanical systems (MEMS) are devices exhibiting micron-size features, having ample potential in a diverse array of functions primarily concerning micro-scale activities. Their precision and scalability allow for such diversity and MEMS have therefore attained interest in numerous academic and industrial sectors. One industry with distinct interest in these devices is the biomedical industry. Research has shown that MEMS devices have the capacity to be utilised as micro object characterisation tools where one particular sub-category is the diagnosis of certain diseases which affect a cell's mechanical integrity. Through a collaboration between the Faculty of Engineering and the Faculty of ICT, this project set out to design and develop MEMS devices suitable for manipulation and mechanical characterisation of single biological cells, particularly human red blood cells. Such applications impart strict thermal and structural specifications by which potential MEMS devices must abide so as to perform the exercise without damaging the biological cells being investigated. Several device configurations were designed and fabricated using a commercially available fabrication technology known as SOIMUMPs™. State-of-the-art finite element analysis techniques together with experimental testing have demonstrated that the devices are potential candidates for the intended function.

Mathematical Modelling of Metabolism, With Applications on the Bacteria Campylobacter Jejuni

Ms Yanica Said

Department of Mathematics, Faculty of Science

The bacteria Campylobacter jejuni is recognised as one of the primary causes of food poisoning in the world. Although C. jejuni's metabolism has been described to be limited, its ability to survive and contaminate various food sources suggests that its metabolic capabilities are fairly flexible and merit further investigation. One of its most intriguing features is its use of oxygen — this organism has the potential capacity for anaerobic respiration but requires small amounts of oxygen to grow.

In this talk, I will discuss how we computationally investigated this phenomenon using a Genome-Scale Model of C. jejuni M1cam. Genome-Scale Models are mathematical recreations of the metabolic pathways within an organism, constructed from the annotated genome. I will outline common metabolic modelling techniques and illustrate how we used them to predict how C. jejuni alters its metabolism in response to variations in the amount of oxygen within its environment. This investigation led to the identification of various routes for energy generation in C. jejuni and indicated that oxygen is required for the production of pyridoxal phosphate, a compound that is essential for growth.

Doctoral Stream DS2.3

Social and Behavioural Sciences / Life Sciences and Medicine

CHAIR: **Mr Andras Havasi**

A Mixed Methods Systematic Review of the Issues Which Marginalise Females With ADHD

Ms Sarah Cilia Vincenti

Department of Mental Health, Faculty of Health Sciences

Prior to embarking on a Photovoice project to empower Maltese adult women with ADHD, extant literature was consulted with the aim of ascertaining whether females with this disorder are a marginalised group. A preliminary search indicated that both biological and social factors contribute to this marginalisation and therefore the review question could be answered by both quantitative and qualitative studies. Consequently, a systematic review was undertaken in conformance with the Joanna Briggs Institute methodology for mixed methods systematic reviews (Lizarondo et al., 2020).

This presentation aims to arouse an appreciation of the potential and complexities of mixed methods systematic reviews (MMSRs). The latter merge the customary rigorous steps of a systematic review with the tenets of mixed method research. By doing so they yield a more holistic synthesis of evidence and ensure that their conclusions are more beneficial to practitioners and policy makers. This MMSR followed a convergent integrated design and a pivotal step in the protocol of this review involved transforming extracted quantitative data into qualitative data to allow for integration of findings.

The review concluded that there is an inequitable gendered cycle of ADHD diagnosis at play placing undiagnosed females at a greater risk for psychiatric comorbidities. Moreover, hormonal factors and gender role expectations further disadvantage women with ADHD compared to their male counterparts. These findings help clinicians grasp the nuances and implications of female ADHD.

Investigating the Molecular Mechanisms of Combination Therapy on Drug-Resistant Chronic Myeloid Leukaemia

Mr Antonio Polidano Vella

Department of Anatomy, Faculty of Medicine & Surgery

The project aims to bring chronic myeloid leukaemia (CML) closer to a cure using the combined administration of promising drugs from successful preliminary in vitro experiments.

CML is characterised by the uncontrolled proliferation of myeloid cells in the bone marrow after acquiring the Philadelphia chromosome. CML may be controlled using mono-therapeutic drugs such as imatinib, however, it is increasingly common that patients develop primary or secondary resistances to the drug.

Combination therapy using imatinib and ATRA co-administered with other drugs, such as Venetoclax and arsenic trioxide respectively, has already shown promising results where the leukaemia was managed significantly better than if singular drugs were administered. In view of these discoveries, a study using FDA-approved chromatin modifying agents (CMAs) were combined with imatinib and ATRA in in vitro experiments, producing significant results. Combination treatments not only increased susceptibility to imatinib, but also re-sensitised imatinib-resistant cells to the drug. Furthermore, these combinations showed no toxicity to healthy blood cells thus proving to be potential treatments for CML patients.

Objectives of this project include identifying mutations that cause imatinib resistance and finding the optimal drug combination to treat each mutation. Research is being deepened with studies on molecular mechanisms, namely, gene expression assays and cell surface marker detection, to ensure that the pathways causing differentiation and anti-proliferative effects are fully understood. Tests will then proceed on CML patient blood samples to ensure that successful combinations will have clinical application and give new hope for the treatment of CML patients.

Expo Stream ES2.1

Humanities, Education and Law

CHAIR: **Dr Charles Farrugia**

Beyond the Temples: Climatic, Landscape, and Ecological Perspectives on Maltese Prehistory

Dr Huw S. Groucutt

Department of Classics & Archaeology, Faculty of Arts

The Maltese Islands have fascinated generations of archaeologists. This is most iconically shown with the interest given to the Late Neolithic megalithic 'temples', which are among the oldest complex buildings in the world. In this talk I will explore new research being conducted by the Department of Classics and Archaeology and collaborators, particularly the recently launched European Research Council Funded IslandLab project led by Prof. Eleanor Scerri. These new research directions explore the climatic and ecological background to the arrival of humans in the islands, and the continued impacts that environmental changes had on prehistoric human societies. As well as considering aspects such as the response of human societies to processes such as droughts, this research evaluates the resources available in the islands, and how humans attempted to transform the landscape to ensure long-term survival. As well as its intrinsic interest, lessons can be learned on societal resilience and adaptation. Because of their small size, semi-isolated location, and relatively arid climate, the Maltese islands acted as a natural laboratory for early human societies.

Ensuring Access to Tertiary Education for Students With Disability

Prof. Paul A. Bartolo

Department of Psychology, Faculty for Social Wellbeing

The ACCESS-Disability Support Unit (ADSU) is currently conducting a 2-year research project titled 'Access to tertiary education for persons with disability' (ACTED) (2022–24). The Principal Investigator is Prof Paul Bartolo and the study is sponsored by the Ministry for Inclusion Voluntary Organisations and Consumer Rights. The project aims to improve the equitable participation of persons with disability, specific learning difficulties, medical and mental health conditions in higher education. It involves both quantitative and qualitative research with students with disability. Three questionnaires and individual semi-structured interview schedules were developed and have been completed by students with disability in higher secondary schools, sixth forms, and the university, and are being analysed. These were developed through a systematic scoping review of the relevant research in three databases – ERIC, PsycINFO and Web of Science. A thematic analysis of 132 research articles that reported the voices of students disability identified three main themes: firstly, the student higher education experience was an opportunity for the development of their own self-identity; secondly, the studies described how students struggled for full membership in the university community, calling for a transformation of physical, social and teaching environments for them to access and participate in university academic and social activities; and, finally, students valued individual accommodations in both coursework and assessment. The project findings will promote the higher education aspirations of students with disability, while providing our university and higher education institutions internationally with a framework for enhancing policy and provision to ensure equitable participation for students with disability.

What are They Eating? Developing Tools to Explore Maltese Young Children's Dietary Patterns

Prof. Suzanne Piscopo

Department of Health, Physical Education & Consumer Studies, Faculty of Education

Details on the contemporary eating patterns of Maltese Primary school-aged children is scarce. Considering this gap in knowledge, this research study aimed to develop two dietary assessment tools, one for junior and one for senior Primary schoolchildren. Six focus groups were held in different schools around Malta to establish a pool of commonly consumed foods and drinks at different eating occasions. This was complemented by six 24-hour diaries recorded by the parents of young children. Altogether, the data obtained informed the development of the two tools. The intention was to look at frequency of food and drink consumption with analysis aimed to gather information at the food not nutrient level as weights and measures would not be calculated. The tools were developed in Maltese and English and were pictorial in nature, mainly asking children to tick how frequently they consumed an item – everyday, sometimes, weekend only (if applicable), never – for breakfast, for their school packed lunch, for a meal after school, for supper and as a snack. Some special questions also looked at whether food was eaten at grandparents, when eating out and how particular foods consumed were prepared. The dietary assessment tools were piloted with five senior and five junior children groups in different state and non-state Primary schools. Children whose parents had completed the diaries also tested the tools. The feedback collected from the piloting session is currently being analysed in order to review the tools and finalise for eventual launch on a national level.

Immunity (or Vaccine) Passports: A History of a Document

Dr Marc Kosciejew

Department of Library Information & Archive Sciences, Faculty of Media & Knowledge Sciences

The immunity (or vaccine) passport of the coronavirus pandemic, as a concept and object, is not unprecedented. This health and identity document features a long history spanning over half-a-millennium and appearing across diverse geopolitical and sociocultural contexts. This presentation offers a documentary history of the immunity passport and its heterogeneous material instantiations, uses, and effects across divergent historical settings. It illuminates how the immunity passport has helped shape identities and public health, as well as impacted individual and institutional agency, during health crises.

Four historical cases are presented, specifically the plagues ravaging the Renaissance Mediterranean region, the 1665 Great Plague of London, the yellow fever outbreaks in the antebellum slave-era southern USA, and the chronic cholera conditions confronting colonial-era British India. Although disparate, these historical cases share the immunity passport as a non-pharmaceutical intervention into their respective health crises that played important roles in people's lives during these troubled times.

Food Security Among Community-living Elderly: A Case Study in Malta

Dr Karen Mugliett

Department of Health, Physical Education & Consumer Studies, Faculty of Education

This research was conceived as a transdisciplinary study on elderly holistic wellbeing, harnessing the expertise of different researchers from the University of Malta (UM). This abstract is about one of the studies carried out and which explored the food security among the elderly across the island of Malta. The study provides evidence and recommendations for future policy, programme, services, infrastructure and education planning to facilitate adequate, safe and pleasant nutrition for senior citizens at national and community level. It involved the direct involvement of the senior citizens in highlighting their challenges, concerns and solutions. The aim was to seek insights as to the practices, barriers and recommendations for safe, adequate, pleasant nutrition for the elderly and existing or desired support in the form of education, programmes, services and infrastructure at community level in particular.

The elderly were initially be reached via Day Centres and other elderly groups and a snowballing technique was then used to recruit a sample of 264 elderly where a questionnaire was administered. Once this data was analysed, 3 focus groups were conducted in 3 different communities.

The results show that the majority of elderly in this study were able to access food, prepare food and have different meals and snacks throughout the day. Diet-related diseases did act as barriers to desired foods, as did living alone. Most elderly living alone did not feel the desire to cook for themselves. The fact that the respondents had grown up on a diet of home-cooked meals, seemed to have impacted their food choices until old age as most still mentioned traditional plant-based foods like typical vegetable soups or reminisced on how much they cooked when they had a full family but do not now because of a number of factors. Most elderly still had support for accessing food through family members and did not seem to be food insecure. Predominantly food preparation is still largely in the hands of females, though men do help when the wife is not able to stand for long or has other ailments. It was common that the evening meal was lighter and the principal meal was at lunch time. Very few of the respondents made use of the state subsidised food meals service. The elderly would welcome more information on food and nutrition and how to eat healthily despite their multiple conditions.

In conclusion, the majority of the surveyed older persons appear to be fairly food secure; however, further research is required to determine nutritional adequacy, related barriers, and to obtain data for very old persons not surveyed.

Expo Stream ES2.2

Architecture and STEM

CHAIR: **Dr Inġ. Simon Borg**

The Megalithic Temples of Malta are UNESCO World Heritage Sites: Evaluating the Performance of the Open Sided Protective Shelters

Ms Rosangela Faieta

Department of Conservation & Built Heritage, Faculty for the Built Environment

The UNESCO-listed Maltese Megalithic Temples were built between the mid-fourth and the mid-third millennium BC, and represent an important and unique Maltese heritage that needs to be preserved. Their conservation has been compromised due in part to the local aggressive marine environment, leading to a series of cumulative conservation problems. The Mnajdra and Ħaġar Qim Temple sites were covered with open-sided protective shelters in 2009, followed by the Tarxien Temples in 2015.

Protecting the megaliths from the effects of heavy rainfall, high temperatures and strong solar radiation, the shelters have now been in place for close to 15 years; it is therefore crucial to scientifically evaluate the effects of these shelters on the new micro-environment and how this could impact the conservation of the megaliths, to inform future conservation decisions.

The presentation will outline a current project, commenced in 2019, which evaluates the performance of the shelters over the specific case of the Mnajdra Temples, through a multidisciplinary approach.

The project has two important aims: one, involves periodic non-invasive on-site analysis to identify, document and monitor the types of degradation in specific site areas, whilst also analysing the thermal variations, and external depositions.

The other consists of environmental monitoring and data analyses, in particular the action of wind, also as altered by the presence of the shelters. This behaviour is being modelled and simulated using CFD, to link to site-specific degradation phenomena, including salt crystallisation, wind erosion and particle deposition.

Conservation of the Pérez d'Aleccio Great Siege Wall Painting Cycle: Research and Implementation

Prof. JoAnn Cassar

Department of Conservation & Built Heritage, Faculty for the Built Environment

The Department of Conservation and Built Heritage recently completed the conservation of the 16th C Great Siege wall painting cycle in the Grand Master's Palace in Valletta. The cycle was painted between 1576–1581 by the Italian artist Matteo Pérez d'Aleccio and constitutes a unique record of the historical event, as well as being the first monumental artwork commissioned by the Knights of St John of Malta.

The conservation project was initiated in 2018, and provided students of the MSc in the Conservation of Decorative Architectural Surfaces with first-hand conservation training, under the close supervision of the Department's academic staff, who are also trained professional wall paintings conservators. The project was funded with support from the RIDT, and employed a total of 15 post-graduate professional conservators and hosted 4 interns during the period 2018–2023.

Conservation of such an important and large-scale artwork is underpinned by critical phases of research into the history of the site; scientific analysis to understand the original materials of the painting and causes of their deterioration; and research and testing of conservation interventions. This talk will outline the phases of research undertaken in support of the conservation intervention, and highlight some of the key findings. Emphasis will be placed upon the ways in which the results of research and analysis directly impacted conservation decisions, and ensured the safe treatment of this iconic artwork.

Monitoring Knowledge Risks Through Living Mathematical Models of Human Activity

Dr Mark Micallef

Department of Computer Science, Faculty of Information, & Communication Technology

The most valuable asset owned by companies competing in the knowledge economy is the knowledge held by their employees. This knowledge empowers organisations to create, deploy and maintain operational systems that generate revenues. As people move in and out of teams and organisations, so does the mission-critical knowledge that they hold. If this is not managed, companies can be exposed to severe knowledge risk, defined as: "operational risk caused by a dependency on, loss of, unsuccessful intended or unintended transfer of knowledge assets, and results in a lack of, or non-exclusivity of these assets".

The intangible nature of knowledge makes it difficult to manage, with traditional codification strategies often falling short due to documentation going stale in fast-moving commercial environments. In this talk, we will provide an overview of research whereby we have been investigating a cartographic alternative to codification strategies. We are interested in building and analysing maps of "who knows what" within a knowledge-intensive company. We do this by analysing human interaction with software tools on a daily basis and drawing conclusions about what specific interactions tell us about the knowledge held by individuals. This allows us to construct living mathematical models that can be analysed to highlight knowledge risks. Subsequently, these risks can be presented to management, who can decide whether an intervention is required.

Groundwater Monitoring From Ambient Seismic Noise

Dr Matthew Agius

Department of Geosciences, Faculty of Science

The Maltese islands face high levels of water stress due to low rainfall and dependence on groundwater abstraction. Until now, in-situ borehole readings have been the only method utilised to monitor the quantitative status of groundwater in the Maltese islands. We propose an innovative, cost-effective approach to groundwater monitoring using ambient seismic noise data recorded on the Malta Seismic Network as part of the project SIGMA (Seismic Imaging of Groundwater for Maltese Aquifers). We investigate temporal changes in seismic velocity as an indication of the variability of water in underground rocks. Water-saturated rocks have an increased pore pressure, which, in turn, leads to the opening of cracks in the rock that reduces the contact area between different grains of rock, resulting in a decrease in seismic velocity. We find that the changes in the seismic velocities have seasonal patterns and compare well with the time series of groundwater measurements from nearby boreholes. Project SIGMA is financed by the Energy and Water Agency under the National Strategy for Research and Innovation in Energy and Water (2021–2030).

Documenting the Spread of Marine Invaders Through Two National Citizen Science Campaigns

Prof. Alan Deidun

Department of Geosciences, Faculty of Science

Citizen science is the collaboration between scientists and the general public as volunteers to gather and/or analyse data relating to phenomena in the natural world which, due to a number of attributes, are difficult to monitor through conventional scientific methods. There is much scope for marine citizen science, including fields such as on land and along shorelines, in shallow waters and in the open sea.

The Spot the Jellyfish citizen science campaign was launched in June 2010 by the Oceanography Malta Research Group at the University of Malta and the International Ocean Institute (IOI), with the support of the Malta Tourism Authority (MTA). The campaign has been commended on numerous dissemination portals, including EuroNews in 2022, for the good practice standards it showcases. In 2017, a second marine citizen science campaign, Spot the Alien Fish, was launched by the same research group and by the IOI. Three highly-invasive marine species whose occurrence and distribution within Maltese waters is being tracked through the two citizen science campaigns in question include the nomadic jellyfish (Rhopilema nomadica), the blue swimmer crab (Portunus segnis) and the reticulated leatherjack (Stephanolepis diaspros).

The status and profile of citizen science within the marine realm is such that it has prompted the European Marine Board (EMB) to dedicate Position Paper no. 23 ('Advancing Citizen Science for Coastal and Ocean Research') to citizen science and the EU Commission's Mission Starfish and the UNESCO's 2021–2030 Ocean Sciences Decade to adopt citizen science as one of their chief citizen engagement tools.

Cosmology From the Moon

Prof. Kristian Zarb Adami

Department of Physics, Faculty of Science

This talk will focus on the developments in Low-Frequency Radio Astronomy technology, from single antenna global signal detection of the Epoch of Reionisation to the Square Kilometre Array (SKA) which will be capable of imaging the high-redshift H1-signal from the cosmic dawn through to the Epoch of Reionisation. I will argue that the future low-earth orbit satellite missions such as STARLINK and the limiting characteristics of the ionosphere to carry out low-frequency astronomy and cosmology will naturally lead us to considering the deployment of radio antennas on the far-side of the moon. I will end the talk by describing technologies that have already been developed for the robotic deployment of antenna arrays and describe how these automated methods for generating radio apertures can be trialled in remote areas on Earth.

Expo Stream ES2.3

Architecture and STEM

CHAIR: **Prof. Ian Thornton**

Self-screening Electrical Impedance Mammography

Prof. Cristiana Sebu

Department of Mathematics, Faculty of Science

This project is devoted to the design and construction of a prototype for a novel and opti-mised integrated circuit based wearable electrical impedance mammographic system, as well as to the development of a computationally efficient image reconstruction algorithm which could be used to detect the size and the location of breast tumours in real-time. The advantages (portability, low cost, little or zero patient discomfort, no known patient risk and no known side effects) of an impedance imaging system over traditional X-ray mammography make this technology a welcome addition to the tools available in the fight against breast can-cer.

3D Reconstruction and Immersive Applications

Ms Tram Thi Ngoc Nguyen

Department of Criminology, Faculty for Social Wellbeing

The SIntegraM MAKS Immersion Lab is currently carrying out a long-term project with the focus on large-scaled 3D data capture, reconstruction, and dissemination in various immersive environments. Various high-end LiDAR and image-based scanning devices are used to capture a wide range of data above ground and underground. Three-dimensional models are reconstructed and presented in virtual reality (Oculus Quest and Rift), augmented reality (Magic Leap and Hololens), and the Computer Assisted Virtual Environment (CAVE). Several applications have been developed in the field of GIS, forensics and criminology, cultural heritage, environmental preservation, archaeology, digital arts, education, and many more.
The project is funded by the European Commission, the Malta Planning Authority, and the University of Malta.

Reducing Energy Generated Intermittency Through Voltage Regulation

Dr Oussama Guellout

Department of Industrial Electrical Power Conversion, Faculty of Engineering

The continued growth in roof-top photovoltaic (PV) systems is affecting the way electrical power flows in the Maltese distribution network. Traditionally, power flows from the centralised generation to the load (unidirectional), however with the introduction of distributed generation such as PVs, bidirectional power flow can occur during periods of low electricity demand. This brought new challenges for the distribution system operator to guarantee the quality of supply to its customers. One of the challenges is the voltage rise that can occur when the PV systems are actively exporting energy into the grid and the load demand is low. In such cases, the power flow reverses and current is fed back from the consumer into the grid. Intrinsically this will result in a considerable increase in voltage at the consumer end when the collective energy injected by the neighbouring PV installations is substantial. Apart from the negative aspect that consumers suffer from higher grid voltage, PV systems will disconnect themselves from the grid as a protective measure and hence energy generation is lost. Correspondingly, the voltage will go down again, and the PV reconnects until the voltage increases again. This cycle will continue indefinitely and will result in an intermittency of renewable energy generation. The main objective of REVOLT is to develop a technical solution through detailed design, modelling and simulations of a device to perform real-time voltage regulation at the consumer premises that eliminates the intermittency of renewable energy sources. A lab-based prototype shall also be developed to demonstrate the effectiveness of the proposed technical solution.

ATLANTES

Ms Ritu Kandari

Department of Industrial Electrical Power Conversion, Faculty of Engineering

The port of Valletta is a busy commercial hub that serves as a gateway to Malta and the Mediterranean region. However, the port's activities contribute significantly to Malta's carbon footprint, mainly through the use of fossil fuels to power the ships docked at the port. In response to this challenge, the planned shore power facilities in the port of Valletta will allow docked ships to connect to the local power grid. Shore power is expected to reduce the GHG emissions and air pollution, leading to significant environmental and health benefits. While the adoption of shore power generation at the port of Valletta represents a significant step towards reducing Malta's carbon footprint and promoting sustainable development in the region, the energy used for shore power mainly comes from LNG-powered central power stations. The project is currently looking at the impact of cold ironing on the Maltese power system. This will enable the development of a strategy to integrate green shore power infrastructure that can allow marine vessels (cruise ships to container ships to tugboats) to connect to shore while berthed without producing any emissions. In the later stages of the project, Port microgrids shall be proposed to expand the shore power infrastructure and deploy clean power at the shore power facilities. Additional technical measures that can lead to the establishment of an emission control area in the port of Valletta shall also be explored.

Towards the Synthesis of Molecular, Auxetic Networks

Dr Maria Cardona

Department of Metamaterials Unit, Faculty of Science

Auxeticity is a non-conventional property whereby a material becomes wider when stretched and thinner when compressed, a result of a negative Poisson's ratio (a fundamental material property which is the negative ratio of the transverse strain and axial strain). 1) The design of auxetic materials is an emerging field of research, which aims to deliver new materials with improved qualities such as enhanced fracture and vibrational damping ability, augmented resistance to indentation and synclastic curvature. 2) A calix[4]arene-based network system has previously been studied through molecular simulation and shown to possess auxetic behaviour when the calixarenes are linked through para-para biphenyl linkages. 3,4) This arrangement mimics an "egg-rack" structure consisting of alternate-facing four-legged claws arranged in a square grid which opens up in all directions like an umbrella when the structure is loaded in tension. In this study, we explore a different design of calixarenes which mimic this "egg-rack" structure. Our design proposes the use of calix-tubes covalently linked together by rigid linkers and held into shape through supramolecular interactions within the structure. We study their potential auxetic behaviour through force-field based simulations and carry out a systematic study to explore the change in the mechanical properties upon modification of the constituents of the ring and on the connecting linkages. This provides a design rationale for the potential synthesis of novel calixarene-based systems which are inherently auxetic, leading the way towards novel materials with improved properties.

Graph Domination, Graph Isolation and the Art Gallery Theorem

Prof. Peter Borg

Department of Mathematics, Faculty of Science

Graph theory is an area of discrete (finite) mathematics that has soared in popularity during the last century. A graph here is not the usual plot but the abstraction of a network. Thus, graph theory is, loosely speaking, the mathematics of relations and connections, and can be applied to all networks (social / computer / communication / internet / transport / etc.). A graph consists of a set of objects, called vertices, together with a set of relations, called edges; any two vertices are either related (form an edge) or not related. The closed neighbourhood of a set S of vertices consists of the vertices in S together with each vertex that is related to at least one of them. It is denoted by N[S]. If N[S] contains all the vertices of the graph, then S is called a dominating set. Domination theory is the popular study of dominating sets. Recently, this has been widened to the study of isolating sets, where the graph obtained by removing N[S] must not contain copies of members of a prescribed set of graphs. The Art Gallery Theorem (ALT) says that an 'art gallery' (a polygon in general) can be guarded completely by at most n/3 guards. The author's recent collaborative work on domination and isolation particularly led to extensions of ALT. This work will be outlined.

Poster Stream

Unveiling the Impact of Retargeted Advertising in the Digital Age

Mr Ivan De Battista

Department of Marketing, Faculty of Economics, Management & Accountancy

In today's world, where the Internet has become an essential component of young people's lives, online advertising has become increasingly ubiquitous. Artificial Intelligence (AI) in advertising has enabled precise targeting and personalisation. Retargeted advertisements have become a robust tool for marketers, targeting users who previously visited their websites, among others. This study examined the relationship between six key advertising factors: entertainment, informativeness, irritation, credibility, personalisation, and interactivity, the value of retargeted advertising, and young people's attitudes towards it.

Data from a representative sample of 521 young Maltese people were collected, of which 480 respondents were valid and usable. We used Partial Least Squares Structural Equation Modelling (PLS-SEM) to evaluate the theoretical model and investigate the relationships between the various constructs. The findings revealed that entertainment, interactivity, and personalisation were strongly associated with the value of retargeted advertising. Informativeness and credibility were also positively correlated with advertising value. We did not find any significant statistical relationship between irritation and retargeted advertising value, though it was found to be negatively associated with attitude. We did not observe any association between personalisation and young people's attitudes towards retargeted advertising.

Interestingly, the study found a significant association between advertising value and attitude, suggesting that young people may have a positive attitude towards advertising that they perceive as valuable, useful, and important. The findings suggest that advertisers should produce entertaining and interactive content that is informative and credible, while policymakers need to formulate more effective policies regarding retargeted advertising aimed at young people.

Sub-Saharan African and Eastern European Migrant Women's Perinatal Experiences in Malta: An Interpretative Phenomenological Analysis

Ms Christie Hili

Department of Midwifery, Faculty of Health Sciences

The aim of this research is to explore Eastern European (EE) and sub-Saharan African (SSA) migrant women's perceptions and experiences of the perinatal period in Malta.

In-depth interviews were conducted with a purposive sample of eight SSA (Eritrean and Nigerian) and twelve EE (Bulgarian, Romanian, and Serbian) migrant women, recruited from the Discharge Liaison Midwives service in the general state hospital. The interviews were audio-recorded and transcribed verbatim. Data was collected following ethical clearance. Data analysis followed interpretative phenomenological analysis methodology (IPA) whereby the researcher engaged in a lengthy process of close, line-by-line interpretation of participants' narratives, through which Group Experiential Themes emerged.

SSA and EE women endured diverse struggles during the perinatal period, mainly concerning the need to work for economic survival, being subjected to xenophobic attitudes, and communication barriers. Participants longed for the support of significant others and considered the partner as an anchor to hold onto. The disruptions brought about by the COVID-19 domino effect left an emotional scar on EE women, particularly because travel restrictions were the culprit of isolation and loneliness. EE's held perception towards normalising medicalisation of pregnancy and childbirth contrasts SSA women's beliefs of letting nature take its course. Moreover, participants valued receiving compassionate and respectful maternity care and felt safe in the hands of health professionals.

These findings are part of an ongoing doctoral research which intend to serve as a groundwork for the implementation of maternity healthcare models aiming to improve the perinatal experiences of migrant women in Malta.

Water-soluble Fluorescent 4-amino-N-aryl-1,8-naphthalimide Logic Gates for Saccharides and Metal Cations

Mr Gabriel Gauci

Department of Chemistry, Faculty of Science

Twelve novel fluorescent logic gates were designed and synthesised on a modified "fluorophore-spacer-receptor" model, with the compounds being built around a naphthalimide fluorophore. Aryl moieties, present at the imide position, included simple aryl rings (compounds 1, 2, 5, 6), crown ether moieties (3, 4, 7), and phenylboronic acid moieties and similar derivatives (8–12). Substituents at the 4-position included piperazine (1–4, 11, 12), azetidine (5–7), and chlorine (8–10). The compounds were studied by means of UV-visible absorption spectroscopy and steady state fluorescence spectroscopy.

Compounds 1–12 were studied as a function of proton concentration (pH) and solvent polarity. Compounds 3, 4, and 7 were also studied in the presence of cations, including sodium and barium(II). Compounds 8–12 were also studied in the presence of monosaccharides, such as glucose, fructose, and galactose. All studies were carried out in water, methanol, and several water/methanol mixtures.

The logic shown by the compounds was described either as one-, two-, or three-input, depending on the environment in which the compounds were studied. Several types of logic were observed, including PASS 1 logic, YES logic, AND logic, INHIBIT logic, combinatorial AND-INHIBIT-OR logic, and combinatorial OR1,2-INHIBIT3 logic.

Solvent polarity has shown to be an important factor when considering the fluorescence of 1–12, with the logic of the compounds changing drastically upon slight changes in solvent polarity. This discovery opens up the possibility of revisiting existing compounds and modifying their logic behaviour by simply tuning the solvent polarity in which they are studied, thus allowing for more potential applications.

Climate Change Adaptation Frameworks and Micro, Small and Medium Enterprises in Small Island Developing States: Results From a Systematic Review

Mr Colin Mattis

Islands & Small States Institute

Climate change adaptation has been identified as an essential policy response to the negative impacts of climate change. While most of the adaptation research has focused on responses and strategies that are implemented by the public sector and large multinational companies, there is a gap in knowledge on how micro, small and medium scale enterprises (MSMEs) are adapting, and whether suitable theoretical frameworks exist to accommodate the specific needs of MSMEs. Empirical evidence of MSME adaptation is also scarce when applied to small island developing states (SIDS), which are highly vulnerable and disproportionately impacted by climate change.

This research involves the execution of a systematic literature review by adopting the PRISMA method, with the objective of providing insights into the drivers, responses and outcomes of adaptation measures implemented by MSMEs, as well as to determine the suitability of various conceptual adaptation options and technologies for MSMEs.

Results show that very little research has been carried out to determine the factors that drive MSMEs to adapt, the actions that are implemented and the extent to which the responses blend adaptation with risk management and resilience. In this regard, the research aims to fill research gaps in an effort to provide a theoretical basis for the development of a suitable policy framework that creates an enabling environment for sustainable adaptation investments and actions by MSMEs in the context of SIDS.

F-isolation in Graphs

Mr Dayle Scicluna

Department of Mathematics, Faculty of Science

For a connected n-vertex graph G and a set F of graphs, a vertex subset D of G is F − isolating if the removal of D and its neighbours from G gives a subgraph which does not contain any graph in F. The F -isolation number ι(G, F) of a graph is the size of a smallest F -isolating set of G. This graph invariant was introduced as an extension to graph domination by Caro and Hansberg in a series of papers investigating its properties and bounds, specifically for when F is the family of stars. Further research on this invariant was undertaken by Borg, Fenech and Kaemawichanurat, which yielded multiple sharp upper bounds for the F -isolation number, particularly when F is the family of cycles, the family of connected graphs with three edges, and k-cliques separately. Our research currently tackles open problems within this research, in particular the isolation of specific cycles, among others.

Applications in this area can be communication networks and social network analysis. Let us take an example adapted from Caro and Hansberg's paper that introduced this subject. Suppose that graph G represents a company's computer network. A director wants to retrieve conversations between two computers in this network. Let D be the set of computers that can listen to all the conversations happening in their neighbourhood. It could be possible that the director may check all the possible conversations without checking the whole computer network. This can happen if certain computers are not connected to each other.

Resisting Allochronism Through Cinematic Temporality in the Postcolonial Fiction of Contemporary Women Filmmakers from Palestine and Israel

Ms Rebecca Anastasi

Department of Media & Communications, Faculty of Media & Knowledge Sciences

Since the dawn of the millennium, women filmmakers from Palestine and Israel have increasingly shifted from documentary to fiction cinema in their creation of memory-narratives, producing their work by relying on an intersection of state and international sources of funding, while carving out a presence within global distribution networks. These dynamics have impacted the temporal politics of the works themselves. Within this context, this thesis' original contribution is distinguished by its use of epistemologies emerging from the intersection of postcolonial thought, feminism and cinematic temporality to examine duration, flow and movement in the acts of memory produced by contemporary Palestinian and Israeli women directors. The thesis opens up the question of how time in cinema is harnessed to resist the gendered denial of coevalness inherent in nationalist and Westernised stereotypes of the region's contested histories, while, concurrently, catering to foreign audience expectations. I adopt a case-study approach, engaging with Annemarie Jacir's When I Saw You (2012, Palestine), Mai Masri's 3000 Nights (2015, Palestine), Suha Arraf's Villa Touma (2014, Israel), and Alamork Davidian's Fig Tree (2018, Israel), pivoting the analyses on the dynamics of visible and invisible cinematic temporalities. In so doing, the linearity of narrative, progressive time – echoing modern time's imperialist structuring, and represented by mainstream cinematic form – is seen to be fractured by untimely "nicks", to echo Elizabeth Grosz (2004). These are active elements which dismantle periodisation, bringing the past into the present, and drawing attention to the unequal, yet relational, chrono-political regimes in Palestine and Israel.

COVID-19 and the Autonomic Nervous System

Dr Rachel Anne Xuereb

Department of Medicine, Faculty of Medicine & Surgery

Background: COVID-19 infection has an adverse impact on the cardiovascular system. Left ventricular impairment, myopericarditis and arrhythmias have been reported in the short term, but long-term follow-up is lacking.

Aim: To assess any residual myocardial and autonomic injury in subjects previously infected with COVID-19 at median follow-up of 5 months.

Methods: A case-control study was performed. Cases were randomly selected subjects who were diagnosed with COVID-19 infection following nasopharyngeal swabbing. Controls were negative for COVID-19 on swabbing and for COVID-19 IgG antibodies. All participants were submitted a standardised questionnaire. Blood investigations were taken including NT-proBNP and troponin I levels. All participants underwent 24-hour ambulatory blood pressure monitoring (ABPM) and 24-hour ECG monitoring. The latter was assessed for underlying arrhythmias as well as heart rate variability (HRV), a measure of autonomic regulation of the heart.

Results: The study comprised 259 subjects, 174 were cases and 75 subjects were age- and gender-matched controls. The mean age was 46.1 ± 13.8 years and median follow-up approximately 5 months. There was no statistically significant difference between cases and controls in cardiovascular risk factors. There was no difference in blood investigations at 5-months follow-up. No difference was noted between the two groups in awake and asleep BP and dipping BP status. No significant arrhythmias were noted in both groups on 24-hour ECG monitoring. However, when assessing HRV, subjects who were previously infected with COVID-19 exhibited lower root-mean square differences of successive R-R intervals (RMSSD), p=0.028. This indicates poor vagus nerve-mediated autonomic control of the heart.

Conclusion: Subjects previously infected with COVID-19 exhibited lower HRV as shown by low RMSSD compared to controls. Reduced HRV is a known biomarker for mortality and sudden death in cardiac disease. The long-term implications of reduced HRV in subjects previously infected with COVID-19 merits further investigation.

Coronary Risk Reduction Intervention for Siblings and Offspring of Patients with Premature Coronary Heart Disease. The CRISO Project

Mr Justin Lee Mifsud

Department of Nursing, Faculty of Health Sciences

This study focuses on a potential risk group without pre-existing atherosclerotic CVD. It is hypothesised that participants assigned to the intervention arm will show more cardio-protective lifestyle-related improvement from the baseline than those in the control group. The researcher will discuss the project's developments and present some preliminary data.

Assessing the Predictive Value of First Trimester Ultrasound and Biochemical Markers in Miscarriage: A Scoping Review

Ms Lara Sammut

Department of Radiography, Faculty of Health Sciences

Vaginal bleeding in the first trimester of pregnancy generates anxiety and uncertainty for expecting parents. Although ultrasound has taken a forefront role in obstetrics and has revolutionised pregnancy management, the ability of determining pregnancy outcome through a first trimester pregnancy scan remains a challenge for obstetricians. Several first trimester ultrasound markers used alone or in combination, as well as ultrasound markers used in combination with biochemical markers have been studied to determine their predictive value in pregnancy outcome. This scoping review was performed to determine which markers have already been investigated for this purpose. An extensive database search was performed, using four different categories of keywords to identify the studies which explored pregnancy outcome following a first trimester ultrasound scan. The search yielded 3,283 studies, of which 123 were ultimately used for this review. Data extraction was performed by two authors independently, based on predetermined eligibility criteria and three data charting forms were used to provide a summary of the results obtained and to enable better flow in evidence synthesis. Data was synthesised using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). Due to discrepancies in study designs, number of ultrasound practitioners, scanning methods, sample populations and follow up duration for pregnancy outcome among these studies, it is difficult to establish a widespread predictive model in order to extrapolate the findings to all pregnant women.

The Authenticity Versus Privacy Debate. Towards Optimal (De)centralised Identity Solutions

Mr Ben Biedermann

Islands & Small States Institute

Any digital identity requires an identifier to which data is tied, but a user may not always desire to share this identifier. The standard for European Digital Identity Wallets (EUDIWs) neither acknowledges the need for nor applies mechanism to blind public keys, putting European Union (EU) citizens' and residents' privacy at risk. Conversely, the University of Malta today uses a solution named Europass to digitally issue verifiable diplomas to its graduates. It allows students to derive signed portable document files (PDFs) from their notarised digital diploma without using a unique identifier in their digital signature.

Europass is a centralised solution, which will potentially be replaced by decentralised solutions like the EUDIW. The EUDIW allows users to receive, store, and present trusted documents on their smartphone. In its current state, however, the EUDIW standard values confidential authenticity over privacy and stays behind the capabilities of decentralised identity at large.

Meanwhile, small jurisdictions have invested in distributed ledger technologies (DLTs) to deliver privacy preserving and decentralised identity solutions. Although the use of DLTs supported initiatives other than the EUDIW reconcile authenticity with privacy, their benefits remain contested. This poster session presents the results from qualitative research on the proposed updates of EU regulations that create the legal basis for EUDIWs, which is grounded in the literature of small island studies and digital identity. Thus, it showcases exploratory work in progress of Ph.D. research on narratives that advocate for public funding of DLTs in small jurisdictions.

Filling the Gaps in Regulating Marine Plastic Pollution From Land-based Sources

Ms Jyothi Thomas

Department of Environmental & Resources Law, Faculty of Laws

The problem of marine plastic pollution transcends national boundaries and has tremendous impacts on biodiversity, climate change, human health, and livelihood. This research analyses the international, regional, and national laws and policies which regulate land-based sources of marine plastic by assessing the practicality of current circularity practices. It explores new approaches that can address the root causes, sources, and repercussions of plastic pollution via inclusive and sustainable measures that favour people, the environment, and the economy.

The methodology of this research adopted two approaches: a desk-based study that reviews the existing literature and the international and European Union legal framework and a qualitative case study of Malta's legislation and policies that regulate land-based industrial and consumer plastic waste sources. The findings drawn from the literature review portray that: 1) a new global treaty on plastic pollution covering the complete life cycle of plastic through circularity approaches cannot assist in addressing land-based sources of marine plastic pollution considering the downsides of circular economy approaches, 2) the European Union laws promoting circularity concepts have a role in controlling the plastic waste generation from land, but they have shortcomings, 3) the plastic legislation in Malta is ineffective in preventing plastic waste, including disposable plastics, microplastics, and their additives, from getting into the ocean. The study proposes an alternative perspective for solutions to the marine-plastic crisis including, a different or upgraded economic structure, a more stringent application of the sustainability concept and the precautionary principle, since the circular economy for plastics is not sustainable.

MOTHERHOOD PENALTY OR FATHERHOOD BONUS? A Case Study

Mrs Vania Tabone

Department of Gender & Sexualities, Faculty for Social Wellbeing

Little or rather no studies have been conducted on the motherhood wage gap and on the fatherhood bonus in Malta. In this research, the focus will be on the outlying roots for the motherhood penalties (Budig & England, 2001) and fatherhood bonus at one particular place of work, the University of Malta.

The New Institutionalism Theory will be used to study how workers/actors working in an institution are 'coordinated' by arrangements taken by others (Rankin, 2017), and the impact this can have on different categories of workers on the basis of gender, nationality, sector, age and caring responsibilities (Cutajar, 2009). The University of Malta has three different sets of workers – academics, administrative/industrial/technical staff and those working on contract. This study will therefore gather data about these three sets of workers, to find out how the motherhood penalty and fatherhood bonus plays out among heterosexual workers.

In this presentation, the focus will be mainly on the literature relating to both sets of concepts – motherhood penalty and fatherhood bonus in which a brief layout demonstrates the facts and findings revealed in the literature review. Various studies conducted around the world on the motherhood penalty show an average motherhood penalty of 7 per cent which can be maintained at 5 per cent if the mothers attend job training or further their education while on career break (Grimshaw and Rubery, 2015). However, the opposite happens to men on becoming fathers, who benefit from a fatherhood bonus that averages to 6 per cent (Hodges and Budig, 2010).

First Results From a Pilot Study: Characteristics of an 18th Century Maritime Collection. A Case Study From the Notarial Archives in Malta

Ms Chanelle Mifsud Briffa

Department of Conservation & Built Heritage, Faculty for the Built Environment

This historical collection is a rich depository of documents which shed light on the social, commercial, and historical activities which took place in Malta from the 17th century to the 18th century. Unidentified discolourations on these documents often makes them difficult to read. This research is focused on the understanding of these patches, to help elucidate their origin and aid in their conservation.

A pilot study conducted on the single folios of this collection has led to the creation of an easily searchable database, based on visual identification, and scientific analyses including IR-photography colourimetry, Raman spectroscopy, Fourier transform infrared, and X-ray fluorescence. By accurately identifying and understanding the paper and its constituents, and its origins and use, the causes of the discolourations can be elucidated.

This poster will present characteristics of the paper substrates and other elements, as observed in the pilot study. The survey shows that this collection comprises of Western and Quasi-Islamic paper. The watermarks and the surface finish strongly suggest Western manufacture, for use in the Islamic world. Other features which support this hypothesis are the mould construction, typical of Western paper mills and seals specific to the Ottoman Empire. The collection was written in Ottoman Turkish, and Latin.

These observations, which are historically significant, will directly lead to the selection of the individual documents to be analysed in a non-invasive manner, and will also, when linked to the results of the non-invasive analyses, help characterise the discolouration and their origins, to help preserve this unique collection.

The Role of Dynamic Information in Face Learning and Identification Project

Ms Tram Thi Ngoc Nguyen

Department of Criminology, Faculty for Social Wellbeing

My doctoral research project titled "Using virtual humans to explore facial identity processing in immersive environments" aims to investigate the role of naturalistic aspects of faces such as 3D form, dynamic information, whole-body context, and socialisation context, in face learning and identification. The first phase of this project focuses on the role of dynamic information. In the first online experiment, participants learnt two identities (static or dynamic) then performed a Face Family Resemblance task. It was found that dynamic information benefited face identification but only when learnt face and test face were both dynamically presented (i.e., congruency effect). The subsequent experiments explore the use of fast periodic visual stimulation (FPVS) in conjunction with electroencephalogram (EEG) – a robust paradigm to objectively measure neural responses indexing face detection performance. The main advantage of the FPVS-EEG paradigm is its high signal-to-noise ratio and performance index being completely free from any noise stemming from decisional factors as seen in behavioural tasks. Results from pilot studies verified the sensitivity of the current 16-channel EEG system to face detection using the FPSV paradigm as compared to the more advanced 128-channel EEG system used in previous literature.

A study on the Effect of Shading on the Performance of Photovoltaic Systems

Mr Matthew Axisa

Institute for Sustainable Energy

The growing need to shift towards generating power from renewable energy sources has contributed to the rise in sustainable power plants to cater for the ever-increasing electricity demands. With current local renewable energy sources dominated by photovoltaics (PVs) and the rapid increase in apartment buildings replacing terraced development, building heights are increasing while roof spaces are becoming saturated with services equipment leaving limited usable space for PVs. While the impact of shading on PV output is well known, previous research has primarily relied on investigating hard peripherally-defined shading from non-movable objects such as buildings and trees, assuming a negligible effect from thin object shading such as poles and cables. This study aims to use outdoor and indoor (environmentally-controlled) experimentation, as opposed to just the use of simulations, to obtain a correlation analysis between the distance of thin objects from a PV system and the resulting loss in energy yield. Several shading scenarios and object thicknesses ranging from 0.2mm to 125mm in diameter have been analysed in numerous shading patterns of typical thin objects found on roofs. The developed relationship yielded the need to derive a unique image processing algorithm to obtain a quantifiable measure of the shading intensity. In this way, the shading pattern of the thin object on PV system could be categorically quantified in percentage umbra and penumbra shadow respectively the separate effect of which is also being understood. The aim of such findings is to aid installers and roof owners to make informed decisions whether to eliminate, move or retain the obstacles on the roof based on the correlation derived from this study to predict the percentage loss resulting from the shading of the thin object/s.

Genetic Studies in Familial Osteoporosis in Malta

Ms Chanelle Cilia

Department of Applied Biomedical Science, Faculty of Health Sciences

Osteoporosis is a complex metabolic skeletal disease having a strong genetic background with bone mineral density (BMD) heritability rate ranging from 50–85%. This project aims to identify known and/or novel genes that play a role in familial osteoporosis in affected individuals. Three Maltese families having multiple relatives diagnosed with osteoporosis (T-score: <-2.5 or Z-score: <-2.0) at the lumbar spine (LS) or total hip (TH) were recruited. Biochemical analysis was performed to exclude other bone diseases. Whole genome sequencing (WGS) was done on selected relatives. Comprehensive filtering strategies were carried out to determine potential causality of the filtered gene variants, using in silico modelling and prediction tools. Following a dominant inheritance pattern, 12 heterozygous missense variants were identified in; ADAMTS20, FN1, KLK14, LRP1, PDK4, PPP2RB, SELP, SULF2, TBC1D8, TGF-β2, TNR, TNRC18, all with an alternative allele frequency of ≤1% and classified as deleterious by the ACMG/AMP guidelines. Shortlisted variants will be genotyped in the Malta Osteoporotic Fracture Study (MOFS) for replication. So far, genotyping of 3 variants resulted in heterozygosity for SELP c.2177T>C associated with lower LS BMD and heterozygosity for ADAMTS20 c.4090A>T accompanied by a lower TH BMD. Five unrelated women with heterozygosity for TGF-β2 c.1136C>T were identified, of whom 4 had low BMD at the LS and hip, and/or sustained a low-trauma fracture replicating our findings. All shortlisted genes and gene variants, alone or in combination are predicted to play a role in bone biology. Functional testing is currently underway to confirm the predicted deleterious effect on the protein.

Exploring the Illness Perceptions of Type-1 Diabetic Adolescents in Malta: A Quantitative study

Ms Stephanie Savona Ventura

Department of Psychology, Faculty for Social Wellbeing

Background: Adolescents with a chronic illness in childhood, such as T1DM, may hold maladaptive illness perceptions and thus are more susceptible to negative consequences, leading to poor adjustment and management of their condition.

Aim: This study aimed to investigate the illness perceptions of adolescents diagnosed with T1DM in order to identify any commonalities within and beyond their specific condition. It is hypothesised that negative cognitive representations of their illness will inadvertently influence their blood glucose control.

Methodology: The research was carried out by administering a standardised Illness Perception Questionnaire to adolescents diagnosed with T1DM. The study population included 42 participants with a near equal gender distribution, aged between 9–19. Participants were recruited through the attending consultant at Mater Dei Hospital.

Results: More than half of the respondents reported experiencing headache, dizziness, fatigue, loss of strength, and nausea. The majority seemed to have a clear understanding of the chronicity and fluctuating character of their condition and appreciate that their condition can be associated with serious health consequences. The majority hold a high perception of personal control and medical treatment available to manage their symptomatology and long-term consequences. Many participants reported negative emotional feelings and anger in respect to their chronic condition. The majority view their disease as related to a past viral infection and simply bad luck.

Conclusion: Maltese adolescents with T1DM demonstrated a variety of emotions, notably sadness and anger, despite having a clear understanding of their condition and its management.

Multicomponent Reactions as a Tool For A Sustainable Future in Chemistry

Mr Roderick Abdilla

Department of Chemistry, Faculty of Science

Planet Earth has entered uncharted territory and without seeming too cliched, humanity has truly brought the environment to its knees. With all the tumultuous scenarios erupting in every corner of the Earth, be it the war in Ukraine, the spreading of viruses and diseases, global inflation and fuel price hikes; global warming and environmental degradation may often be put on the back burner by governments and decision-makers. With all of the above in mind, it all comes down to scientists, chemists and engineers alike who unlike most politicians, can use their logic and knowledge to take concrete action. And that is where the green philosophy comes into play exemplified by organic synthesis via multicomponent reactions (MCRs). MCRs have been gaining significance and attention over the past decade because they are able to furnish complex products by using readily-available and simple starting materials while simultaneously removing the need to separate and purify any intermediates. More so, most of these products are heterocyclic in nature and have been reported to exhibit diverse biological activities. In relation to this, in this study, a range of inter-linked broad networks of multicomponent reactions has been studied under environmentally-benign conditions by first identifying viable reactions and then performing catalyst screening and condition optimisation on a model reaction for each reaction-type. Positively, a catalyst which to the best of our knowledge has never been synthesised before has been observed to be able to drive most of the studied reactions and is easily recoverable and reusable.

Investigating the Effects of Biochar Texture and Quantity on Green Roof Substrate Performance

Mr Antoine Gatt

Department of Architecture & Urban Design, Faculty for the Built Environment

Green roofs are known to mitigate urban related issues. The extent of these benefits is directly related to the quality and performance of the green roof system. The growing medium is generally an engineered soil with a high percentage of inorganic material and low percentage organic matter. Growing media must provide the basic physical, chemical and biological properties for plant development. Biochar has been found to be useful as a green roof component because of its physical characteristics and has been applied successfully in green roof substrates. The aim of this study was to investigate the effects of biochar texture and percentage volume on the performance of a standard green roof substrate. The study aims to establish this mainly through quantitative research with onsite and lab tests.

Two types of biochar textures, pulverised (P) (<2mm) and crumb (C) (>2mm) have been mixed into a standard substrate (Control) at 10% (10) and 20% (20). Various aspects were studied including:

- Stormwater management for flood mitigation and plant health
- Microarthropod population, related to growing medium health

Initial results have shown that texture and volume affect substrates performance. However, what needs to be established is whether these differences are statistically significant or not. It was apparent that crumb treatments had a lower field capacity when compared to pulverised treatments but are able to retain moisture over longer periods. This was confirmed by the fact that pulverised biochar retained higher percentage moisture compared to crumb biochar but lost moisture at a higher rate. Arthropod population cycles were seasonal with higher numbers occurring in spring and winter respectively and lowest counts in summer. 10C treatment had the highest number of arthropods in spring while 10P had the least. The most abundant were Acari and Collembola, as confirmed by other studies.

A Systematic Evaluation and Recommendations on the Acute Stroke Pathway in Malta

Ms Lara Marie Deguara

Department of Clinical Radiology & Nuclear Medicine, Faculty of Medicine & Surgery

The concept of 'Time is Brain' studied by both Gomez in 1993 and Saver in 2006, is a pivotal concept in the treatment of stroke. Stroke is the leading cause of acquired disability and death worldwide (Nichols, Townsend, Scarborough, & Rayner, 2014). Local statistics show that the incidence and prevalence of stroke in Malte increases exponentially with age and is more common in men (Eurostat, 2015). Mechanical Thrombectomy either as a sole treatment or in combination with intravenous thrombolysis is the current treatment followed for patients presenting with acute stroke. Treatment eligibility and success of intervention is heavily time dependent. Patient outcomes improve dramatically when intervention and treatment is delivered at the fastest time possible after initiation of stroke symptoms. Despite having the availability of treatment, in 2015 Micallef et al reported that due to the late presentation of patients to the hospital, only 1.59% of acute stroke patients were eligible for treatment. To date, little is known about the steps involved in the stroke pathway leading to intervention, mechanical thrombectomy, a service which was introduced in Malta in 2015, therefore there is no information regarding whether key performance indicators are being met. Characterising bottlenecks related to timely recognition of stroke, emergency medical services response, notification of stroke team, coordination and parallel management of patient preparation amongst others are essential in ensuring the best possible outcome from intervention, treatment administration and improved long term function outcomes.

Development of Smart and Sustainable Inclusive Workstations for Workers of Different Abilities

Ms Amberlynn Bonello

Department of Industrial & Manufacturing Engineering, Faculty of Engineering

The implementation of digital technologies has allowed manufacturers to attain flexible, rapid and personalised production. However techno-centric advances may take a toll on operators' well-being, considering differences in ages, abilities, and experience. This diversification is at the core of Industry 5.0, where focus is placed on sustainability, resilience and human-centricity; broadening the horizon for inclusion of operators with disabilities who are estranged from the manufacturing shop floor. This research aims to tackle the shortcoming of knowledge on how to design manufacturing workstations that can cater for the needs of such operators. This will be achieved by engaging Industry 4.0 technologies (such as cobots, AR and AI) in the design of smart, sustainable and inclusive workstations. This has been elaborated through a set of preliminary interviews held with engineers from twelve Maltese manufacturing companies. This project poster will present these results which elicit an apparent level of friction between the engineers and the potential of recruiting operators with disabilities, a lack of design knowledge in creating inclusive workstations due to issues such as stigma and lack of awareness, causing an absence of social sustainability with respect to disability employment in manufacturing.

These findings have scaffolded the need for this study, which aims to develop a resilient, user- centred design tool to assist in the integration of people with disabilities in manufacturing. The next stage of this research entails encompassing the emergent themes from the interviews and literature into detailed user-requirements, which will then be discussed with support workers, occupational therapists, parents and people with disabilities. The solutions developed will then be demonstrated to manufacturing engineers to showcase the assistance which can be provided in designing inclusive workstations.

Environment or Genetic Isolation? An Atypical Intestinal Microbiota in the Maltese Honeybee Apis Mellifera Ruttneri

Ms Simone Cutajar

Institute of Earth Systems

Apis mellifera evolved mainly in African, Asian and European continents over thousands of years, leading to the selection of a considerable number of honeybee subspecies that have adapted to various environments such as hot semi-desert and cold temperate zones. A new subspecies, Apis mellifera ruttneri, was identified 25 years ago by Sheppard et al. (1997) in the Maltese Islands. With the evolution of honeybee subspecies, it is possible that environmental conditions, food sources and microbial communities typical of the colonised areas have shaped the honeybee gut microbiota.

Given the interest in honeybee gut microbiota of the European A. mellifera, this study investigates the gut microbiota of A. mellifera ruttneri, looking at its core composition and abundance. High throughput sequencing gave an overview of the overall abundance of bacteria and yeast communities.

This is the first deep analysis of the Maltese honey bee gut microbiota. The study investigates whether there are distinctive differences in the gut microbiota of A. mellifera ruttneri and the two honeybees prevalent in Italy (A. mellifera ligustica and carnica). The analyses carried out show that the Maltese honey bees have a distinctive microbiota when compared to the Italian honey bees, with the most abundant genera being Bartonellaceae and Lactobacillaceae, respectively.

The environment seems to be the main driver in the acquisition of these marked differences in the gut microbiota. However, the influence of other factors such as host genetics, seasonality or geography may still play a significant role in the microbiome shaping, in synergy with the environmental aspects.

Application of Proteomic Approaches to Better Define Diseases

Prof. Byron Baron

Centre for Molecular Medicine & Biobanking

A lot of medical research is based on genetic analyses but a number of effects which are observed in diseases or conditions are due to changes which happen to proteins after they are produced by our genes. These changes to proteins are the results of small chemical groups being added to specific amino acids in the proteins so as to help proteins perform their job more effectively. However sometimes these chemical groups can bring undesired changes to proteins initiating abnormal biochemistry, leading to disease. The smallest of these chemical changes is called methylation but it has a big effect on many important protein properties, including their activity. The enzymes that add such methylations to proteins, called methyltransferases are known to be over-abundant in various diseases including cancers but genetic tests cannot detect changes in the activity of these enzymes. Proteomics is a research field involving the comprehensive study of all the proteins produced by a cell, giving a snapshot of the cellular function at a point in time. It allows for the comparative analysis of not only the proteins as a whole but also most of the small chemical modifications on them. The aim of our research is to apply proteomic approaches to better define diseases through the changes in protein levels and the chemical changes on them, including the identification of methylations on key proteins within pathways essential for various disease characteristics. Moreover, quantifying the activity of these methylation enzymes allows for novel potential treatments.

BAC-OFF – Production of Antimicrobial Peptides

Ms Natalia Araujo

Department of Physiology & Biochemistry, Faculty of Medicine & Surgery

Since the discovery of penicillin in 1928 antibiotics have increased life expectancy by 30 years. Frequent misuse of antibiotics has unfortunately resulted in the appearance of resistant "superbugs", making life-threatening infections hard or impossible to treat. Despite the state of urgency concerning antibiotic resistance, the development of new antimicrobials has reached a bottleneck. The aim of this project is to produce antimicrobial peptides using a biological approach that is more cost-effective than traditional, expensive chemical synthesis.

We are utilising fusion protein technology to overexpress antimicrobial peptides (AMPs) in bacteria. The use of a fusion protein, where the AMP is linked to another protein, maintains the peptide in an inactive form in vivo and allows for rapid, effective purification with minimal downstream processing. The latter steps include release and separation of the AMP from the fusion protein resulting in a pure peptide preparation.

Initial experiments aim to validate the protocol and evaluate the AMPs produced. To this end we designed and produced variants based on naturally produced AMPs that protect organisms, including some found in humans, against infections.

Genetic engineering techniques were employed to synthesise the genes encoding AMPs and clone them into an expression vector designed in our laboratory. After bacterial growth, two chromatographic steps are all that is required downstream for complete peptide purification.

The success of this project will conclude with the production of AMPs that are fast acting and highly cytotoxic to bacteria. Importantly, this methodology will undercut the costs of current, chemical peptide production techniques.

EOG-based Eye Gaze Tracking

Dr Tracey Camilleri

Department of Systems and Control Engineering, Faculty of Engineering

Eye-gaze tracking is commonly used for communication by individuals with limited motor skills who cannot use standard control devices such as keyboards or touchscreens. Our team are investigating the use of electrooculography (EOG) for eye-gaze tracking, mainly for the development of human-machine interface systems. This is an alternative to the standard commercially-available vision-based eye-gaze trackers which are sensitive to lighting conditions and typically costly. Through the Fusion TDP funded EyeCon project, we have developed a novel real-time framework which provides continuous point of gaze estimation from EOG signals and allows for natural head movements. SmartGaze, another MCST-funded project, being done in collaboration with Agenzija Sapport, aims to take this one step further, allowing an individual to naturally control devices in a smart home environment using eye-gaze, head pose and position tracking. Our team is also actively developing a sleek EOG signal acquisition device in the form of an ordinary-looking pair of glasses as an alternative wireless modality to the gold-standard equipment designed for laboratory-based acquisition. The team has also worked on different EOG-based applications including virtual typing and symbol based communication using continuous eye-gaze tracking instead of the standard repetitive eye movements modality to select icons within a grid; eye-swipe typing using a novel hidden Markov model approach; and a reading application which provides more accurate metrics to measure the quantity of reading than the state-of-the-art EOG-based approaches. All of these applications gave promising results when tested on human subjects, indicating the potential of using EOG-based eye-gaze tracking as an alternative means of communication.

Structural Insights Into Xanthine Oxidoreductase Chain Formation and Catalytic Mechanism

Dr Brandon Seychell

Department of Physiology & Biochemistry, Faculty of Medicine & Surgery

Xanthine oxidoreductase (XOR) is a molybdoflavin enzyme occurring in two forms; the reduced form known as xanthine dehydrogenase (XDH, EC 1.17.1.4) and the oxidised form known as xanthine oxidase (XO, EC 1.17.3.2). In humans, it is a 293 kDa homodimer catalysing consecutive hydroxylation of purine degradation. The oxidised form of the enzyme produces hydrogen peroxide and superoxide, both of which are reactive oxygen species (ROS) which can interact with various biomolecules producing adverse reactions. XOR can also produce nitric oxide, a cardiovascular protective molecule. Overproduction of nitric oxide results in the formation of the highly reactive peroxynitrite radical. XOR-produced ROS may provide protection against infection, while at the same time can also lead to inflammation, oncogenesis, brain injury and stroke. XOR is also involved in tumour lysis syndrome as well in ischaemia-reperfusion injury, increasing the levels of ROS in the body. Consequently, presence of XOR in blood can be used as an indication of disease and can act as a biomarker for a number of conditions including oxidative stress and cardiovascular disease.

Recent findings through the application of negative staining and cryoelectron microscopy demonstrated that XOR can also form chains at different conditions, particularly at physiological conditions. This is interesting as the dimer and chain form might have different enzymatic activities, implying that chain formation is involved in activity regulation. XOR chain formation is an intriguing route to investigate since XOR was shown to bind and concentrate on endothelial membranes, leading to an elevation of ROS levels in blood.

α-solanine Versus Temozolomide Against Glioblastoma Multiforme in-vitro: Preliminary Results

Prof. Byron Baron

Centre for Molecular Medicine & Biobanking

Despite optimal treatment, glioblastoma multiforme (GBM) has an abysmal associated prognosis of approximately 15 months. α-solanine, a glycoalkaloid derived from plants belonging to the genus Solanum, has emerged as a promising anti-cancer molecule. Here, preliminary results of a project investigating the efficacy of α-solanine versus temozolomide against GBM in-vitro are presented. Three GBM cell lines, U87MG, U251 and T98G were used for this study. Presto-blue® cell viability assays were conducted to determine the IC50 of α-solanine and TMZ respectively. Trans-well and scratch assays were conducted to determine the effect of α-solanine and TMZ on invasion and migration, respectively. ImageJ® wound healing extensions developed by Suarez-Arnedo et al. (2020) was used to analyse migration assay results. Statistical analysis was conducted using Team (2023) and JASP (Version 0.17.1) [Computer software], and graphically depicted using Excel version 16.71. α-solanine achieved IC50 at considerably lower concentrations compared to TMZ, and induced cellular morphological changes indicative of cell stress across all cell lines. α-solanine significantly decreased migratory rate in comparison to TMZ against cells lines at 24 hours of incubation, however this levelled off with time. α-solanine also significantly decreased relative migration in U87MG and U251 cells. α-solanine also decreased the invasiveness of GBM cells after 72 hours of incubation. Current data indicates that α-solanine is superior to TMZ in decreasing the migration and invasion capacity of GBM cells in-vitro. Further work is being conducted to assess the primary mode of cell death induced by α-solanine through DNA, protein, fluorescent microscopy and flow cytometric techniques.

Error Analysis of Automated Processes in the Digitisation of Receipts and Associated Documents

Dr Leander Grech

Department of Communications & Computer Engineering, Faculty of Information & Communication Technology

In today's digital world, bookkeeping tasks and accounting practices still involve a huge amount of paperwork and tedious manual interventions that ultimately determine process efficiency and cost, and are a barrier to automation. E-invoicing standards have therefore been developed to reduce manual work. However most companies, especially the smaller ones, still make exclusive use of either paper, email or pdf invoices, receipts and purchase orders, where the semantic information is neither seen nor understood by the machine, limiting further processing and automation. It is therefore desirable to have systems that extract the useful semantic information from these documents. In this respect, off-the-shelf commercial products are either characterised by limited functionality, increasing the incidence of human intervention and limiting further tasks, or require the frequent periodic intervention of higher order technical skills to re-train and maintain a working system. In this poster presentation we will discuss an error analysis carried out on a sample of outputs from various models which we have developed for this purpose. The results from this study inform our next efforts in further automating the processes. The work presented is part of the MCST funded "Automated Document Analysis and Classification for Enhanced Enterprise Efficiency" (ADACE3) project that plans to leverage and advance the science of state of the art artificial intelligence algorithms, namely, joint vision-language neuro-symbolic models and never-ending learning techniques, to develop a system that minimises human intervention and is potentially more attractive to the small company market, in terms of cost and ease of use.

Traffic-based Information System

Dr Luana Chetcuti Zammit

Department of Systems & Control Engineering, Faculty of Engineering

Social networking sites serve a very important role in our daily lives, providing us with a platform where thoughts can be easily shared and expressed. As a result, these networking sites generate endless amounts of information about an extensive range of topics. Nowadays, through software development, analysing the content of social media is made possible through Application Program Interfaces (APIs). One particular application of content analysis of social networking sites is traffic. Traffic events can be determined from these sites. Thus, social networking sites have the potential to be utilised as a very cost-effective social sensor, whereby social media posts serve as the sensor information. Advancements in the field of machine learning have provided ways and techniques in which social media posts can be exploited/harvested to detect small-scale events, particularly traffic events in a timely manner. This work aims to develop a traffic-based information system that relies on analysing the content of social media data. Social media content is classified as either 'traffic-related' or 'non-traffic-related'. 'Traffic-related' events are further classified into various 'traffic-related' sub-categories, such as: 'accidents', 'incidents', 'traffic jams', and 'construction/road works'. The date, time, and the geographical information of each associated traffic event are also determined. To reach these aims, several algorithms are developed: i) An adaptive data acquisition algorithm is developed to make it possible to gather events from social media; ii) Several supervised binary classification algorithms are developed to analyse the content of social media and classify the results as either 'traffic-related' events or 'non-traffic-related' events; iii) A topic classification algorithm is developed to further analyse the 'traffic-related' events and classify them into the sub-categories previously mentioned; iv) A geoparser algorithm is further developed to obtain the date, time and the geographical information of the traffic event. A fully functional, real-time, automated system is developed by interconnecting all the algorithms together. This developed system produces very promising results when applied to Twitter data as a source of information. The results show that social networking sites have the potential to serve as a very efficient method to detect not only small-scale events, such as traffic events, but can also be scaled up to detect large-scale events.

Fluorescent Polymeric INHIBIT Logic Gates Based on Natural Products

Prof. David C. Magri

Department of Chemistry, Faculty of Science

Quinine and quinidine are fluorescent natural products derived from the Cinchona tree bark. Quinine is used as an ingredient of tonic water, as a treatment for malarial, and as well as a fluorescence quantum yield standard. The diastereomer quinidine is used as an antiarrhythmic agent for the treatment of heart conditions. Rather remarkably, these molecules have a modular design consisting of a "receptor1-fluorophore-spacer-receptor2-linker" format. In this study, we have developed copolymers, with a "receptor1-fluorophore-spacer-receptor2-linker-backbone" format by copolymerisation of quinidine with acrylamide by a one-step free radical polymerisation process. The photophysical properties of the quinidine monomer and copolymer were studied in water. They both exhibit identical emission maxima at 450 nm, enhancement ratios of 186 and 185, and fluorescence quantum yields of 0.558 and 0.556, respectively, indicating that modularity is conserved within the copolymer.3 Furthermore, we demonstrate that the monomers and copolymers function as H+, Cl^- -driven INHIBIT logic gates that emit a bright blue fluorescence at high H+ and low Cl^- concentrations. This study highlights the use of fluorescent natural products as building blocks for designing intelligent materials with molecular logic-based functions for chemical sensing, material science and cell biology applications.

The First BioBlitz of the Maltese Islands: A Citizen Science Perspective

Mr Arthur Lamoliere
Institute of Earth Systems

Last year, researchers of the Interreg Italia-Malta's FAST project organised the first national BioBlitz on the Maltese Islands. The event aimed to investigate the spatial distribution of Invasive Alien Plant species while engaging the general public and raising awareness about ecological issues related to biological invasions.

This 3-days event took place at l-Inħawi tal-Buskett u tal-Girgenti, a Special Area of Conservation within Malta's Natura 2000 network. The participants were grouped into small teams and trained to identify and collect data using a mobile application before surveying the different sectors of the area of interest. At the end of the event, each participant was required to fill in a standardised survey developed by the European Citizen Science Association.

The BioBlitz successfully engaged the general public, with 65% of participants rating the experience as excellent, and the majority joining because it 'sounded like fun.' Over 300 records of 15 plant species were collected, and the validated records were used to plot a distribution map of the Invasive Alien Plant species.

The collected data provided valuable information on the spatial distribution of alien plant species and also served as a source of social and demographic data that can aid in understanding participants' motivation to continue participating in Citizen Science initiatives. Overall, this BioBlitz demonstrates the potential of Citizen Science as a tool for promoting public engagement in ecological issues related to biological invasions and the conservation of designated natural areas.

Development of a Hybrid Inverter Drive

Mr Daniel Lendi
Department of Industrial & Electrical Power Conversion, Faculty of Engineering

There are currently around 8 billion electric motors in the EU alone, consuming nearly 50% of the electricity produced in the EU. As a consequence of this, EU regulations are constantly aiming for increased efficiency requirements for electric motors. The proposed Hybrid Inverter Drive (HID) project is intended to further build on the increasing efficiency requirements for electric motors by developing a Variable Frequency Drive (VFD) motor starter with the addition of bypass relays. The HID will provide maximum efficiency starting and stopping performance for both induction motors and Permanent Magnet Synchronous Motors (PMSMs) with high torque and minimal inrush currents during starting. It will also allow for the motors to be operated at different speeds. While these are common features already found in many VFDs, the HID will provide an automatic bypass switch-over for 50Hz fixed-speed applications through its bypass relays. This will connect the motor directly to the electric grid once it has been started and synchronised to the grid voltage, which introduces a hybrid mode of operation. Therefore, all losses of the inverter power electronics circuit will be saved. The HID will also be able to introduce higher efficiency PMSMs to fixed-speed 50Hz applications, which would otherwise make use of an induction motor. This can greatly contribute to energy savings in electric drives used in both industrial and domestic applications and help to reduce greenhouse gases and Carbon Dioxide (CO2) emissions.

Importance of Venting in Injection Moulding, a Comparative Assessment

Ms Sarah Mifsud

Department of Industrial & Manufacturing Engineering, Faculty of Engineering

In the injection moulding process, molten plastic is pressurised to fill a cavity and then cooled down to produce plastic parts for various applications. Since the molten polymer is being injected into a cavity, common issues related to cavity filling may occur, such as air trap formation. To avoid such improper cavity filling issues, injection moulding machine operators commonly increase the injection pressure to promote a more complete mould filling. This is not a viable solution as it still causes low-quality products due to the high residual stresses in the plastic parts and may even result in material degradation. Furthermore, such a practice is deemed unsustainable due to the higher energy consumption incurred by increasing the injection pressure, especially when mass producing a series of components. A common solution to this is the use of an active vacuum venting system to evacuate the trapped air out of the cavities before the melt is injected. Currently, all active vacuum venting systems available on the market are either bulky and thus expensive or require complex machining of the mould. This research study deals with the development of a small, inexpensive, easy-to-use active vacuum venting system that does not require the complex alteration and machining of injection moulds. Since the solution may still not be disclosed, a comparative study between moulding with and without venting will be presented, particularly noting the resulting part quality and the required injection pressure which is used as one of the indicators for the final sustainability study.

Text Extraction for Text-to-speech Applications

Dr Alexandra Bonnici

Department of Systems & Control Engineering, Faculty of Engineering

While text-to-speech tools exist, these often support the more common languages, used by millions of people rather than a few hundred. Moreover, many of these text-to-speech tools assume that the text is easily distinguishable from the page background. This is not necessarily the case, particularly in children's books where pictures and illustrations are often part of the background. In these cases, simple binarisation algorithms will fail to distinguish the text from the illustration and the text-to-speech algorithm fails to read such text correctly. This project aims to investigate techniques to eliminate this problem by increasing robust text extraction algorithm able to distinguish text from the illustrations.

Sniffing Out Sepsis: Olfactory Receptor Expression Patterns in Immune Cells During Infection and Systemic Inflammation

Mr Nigel Sammut

Department of Applied Biomedical Science, Faculty of Health Sciences

Background: Sepsis is the dysregulated host response to infection, which leads to fatal organ dysfunction. Recent large clinical genomics studies have uncovered an association between poor prognosis and immune paralysis. Unexpectedly, immune cells had elevated expression of a core transcriptional network encompassing ectopic olfactory receptors (ORs) relative to health. However, the role of ectopic ORs in circulating immune cells and immune paralysis in sepsis is still unknown.

Methods: The study hypothesis is that immune cells activate ectopic OR gene expression programs in response to microbes during sepsis. To test this hypothesis, our study aimed to firstly, map OR expression in immune cells during sepsis, and secondly, test their inducibility through exposure with microbial ligands. To address the study aims, we applied bioinformatics tools to a large cohort of sepsis patients (n=800) and healthy participants (n=42) with genome-wide whole blood leukocyte gene expression profiles, as well as specific peripheral blood mononuclear cells (PBMCs) (n=10).

Results: Whole blood leukocytes of critically-ill patients with sepsis secondary to pneumonia, intra-abdominal, urogenital, cardiovascular and skin infections had significantly altered OR gene expression profiles relative to healthy and non-infectious critically-ill control patients (adjusted $p < 0.05$). Moreover, monocytes and T cells, but not B cells, purified from sepsis patients had significantly altered levels of OR gene expression, relative to healthy patients.

Conclusions: OR gene expression programs are activated in PBMCs during sepsis. Further investigation of the expression patterns of ORs in immune cells during sepsis may contribute towards the identification and future development of specific therapeutic targets.

Demand Parameters for Fault Identification in Sustainable Compressed Air Systems

Mr Massimo Borg

Department of Industrial & Manufacturing Engineering, Faculty of Engineering

Compressed air has cemented itself into being one of the main energy storage and transfer media in the industrial sector, mainly utilised to power pneumatic equipment. Such systems have various advantages including flexibility, ease of use and cleanliness, amongst others. Nevertheless, the presence of faults, such as leaks, is a common occurrence and these drastically reduce the efficiency of the system. Fault repair is often given a blind eye due to the downtime required to locate each fault. Furthermore, current studies in this sector regularly focus on the supply side of the system rather than the demand, with the latter often claimed to have the highest sustainable improvement potential. The proposed research aims at identifying demand-oriented parameters which help in reliably finding faults automatically, without using expensive proprietary equipment. Various systematic experiments were held whereby leaks of various sizes were induced in three locations on the demand side of a pneumatic pick-and-place system at the Faculty of Engineering, University of Malta. Sensor data, including pressure and flow rate measurements, were logged using specially designed loggers to investigate the imposed effects. This led to better understanding the dynamic behaviour of the system, together with identifying the fault-finding parameters. These results contribute to knowledge in this sector and promote a cleaner and more sustainable industry.

Characterisation of Glucokinase Mutations Discovered in MODY-2 Diabetic Subjects

Prof. Gary Hunter

Department of Physiology & Biochemistry, Faculty of Medicine & Surgery

In the pancreas the enzyme glucokinase (hexokinase-4) acts as a glucose sensor, facilitating the release of insulin when glucose concentrations rise, for example, after a meal. Mature onset diabetes of the young (MODY-2) is affected by a heterozygous, monogenetic mutation in the coding region of the gene for glucokinase. Mutations identified in a Maltese cohort (Pace et al. 2021, Acta Diabetologica, 59, 339–348, doi:10.1007/s00592–021–01814–7) were introduced by Site-directed mutagenesis into the coding region of glucokinase using a novel expression plasmid produced in our laboratory for purification and study of altered enzymes. Characterisation by circular dichroism spectrophotometry showed that all five mutations had no effect on protein structural integrity and a small effect on structural stability. Enzymological analysis revealed all five mutations (A119S, G147A, R191Q_, E256K and R397C) had reduced specific activity ranging from 2 to 20% that of wild-type and altered kinetic parameters for KM and VMAX. The molecular basis for the disease is confirmed and the effect of the mutated side chains on the structure of the protein is discussed.

Genetics of Autosomal Dominant Polycystic Kidney Disease in Malta

Prof. Edith Said

Department of Anatomy, Faculty of Medicine & Surgery

Polycystic kidney disease (PKD) is the commonest inherited kidney disorder and a significant cause of end-stage renal disease. Cysts primarily develop in the kidneys but can also develop in other organs. PKD may be autosomal recessive or autosomal dominant. A genetic aetiology is found in 90% of cases of autosomal dominant polycystic kidney and causative variants in PKD1 and PKD2 genes are reported as accounting for 78% and 13% of cases of ADPKD respectively.

A total of 60 unrelated individuals consented to take part in the study. All patients were studied using a customised gene panel by next generation sequencing. Any individuals in whom no variant was identified were studied using whole exome sequencing.

From the epidemiological data collected in the study, the estimated point prevalence of ADPKD for the Maltese adult population is 2.1 per 10,000 inhabitants. Genetic analysis identified a clinically-relevant genetic cause in 82% of cases of which 51% were in PKD1 and 47% in the PKD2 genes. Correlation of the patient's phenotype showed a statistically significant difference between patients with variants in the PKD1 and PKD2 gene as well as with coding impact of the variant identified. The results of the study have shown that the genetic profile of Maltese patients with ADPKD is different from that reported in other countries with a significantly higher percentage of variants identified in the PKD2 gene. The study further emphasises the need for genetic testing of patients with ADPKD and its importance in their clinical management.

A Materiographic Examination of Cavalry Armour From the Palace Armoury

Dr Daniel Vella

Department of Metallurgy & Materials Engineering, Faculty of Engineering

The Palace Armoury at the Grand Master's Palace in Valletta houses an impressive collection of arms and armour spanning >200 yrs and belonging to the Knights of the Order of St John (1530–1798). The collection includes 12 cavalry complete suits of armour inclusive of breast plate with lance rest, backplate, tassets, arm curaisses and closed helmet. Stylistically, these armour suits date to the early 1600s and appear to be of North Italian make. The suits are unique for the collection in that Malta's terrain is not really suitable for cavalry battle and there is no documented evidence to suggest there was ever direct combat involving such. It is thought that the cavalry armour was purchased for off-shore military campaigns.

In this project select Cavalry armour pieces were examined metallurgically and chemically in order to answer the following questions:

1. Curatorial staff at the armoury suspect that the cavalry armour collection was purchased together, and shipped to Malta as a single consignment, perhaps, originating from the same workshop/ or sourced from the same geographical region. Can a comparison of the trace element composition of representative cavalry armour pieces from the collection help conclude on this fact?
2. How were the armour pieces produced? Were there any attempts to harder the pieces? Were similar armour pieces manufactured in the same way, possibly suggesting that the armour was procured by the same hand or workshop?

An Investigation of the Relationship Between the Electrical Conductivity (Salinity) of the Soil Saturated Paste Extract (ECe) With That Measured in a Soil:Water Ratio of 1:5 (EC1:5) in Calcareous Soil from Malta

Dr Anthony Sacco

Institute of Earth Systems

Salinity is one of the major threats to soil as it limits productivity and affects soil health. Arid regions, like those of the Mediterranean are generally affected by this problem, due to the lack of rainfall, high evaporation rate and irrigation. The standard protocol for measuring soil salinity (ECe) involves the preparation of a soil paste which is left to equilibrate over a period of 24 h following which, water is extracted by suction for the determination of the EC. This method is tedious and very time consuming, thus measuring the EC of a soil:water suspension (1:1; 1:2; 1:5) is more commonly used for routine analysis. Converting EC values obtained by the various dilution methods to the standard ECe value is not achieved by simply multiplying these by the dilution factor, as soil properties such as texture and organic matter content play a significant role. Soils are considered saline if the ECe is ≥ 4,000 µS cm-1. A number of conversion coefficients have been proposed for the various dilution methods, and these vary depending on soil characteristics. The scope of this work is to establish a working conversion factor for the soils of Malta, where the routine analysis for soil salinity is the (EC1:5) method. 135 samples of soil with contrasting textural characteristics were collected from around Malta and analysed using the ECe and the EC1:5 methods. The data were analysed by linear regression and the following conversion factor was established:

ECe = 7.23*EC1:5 R2 = 0.9304

Preliminary data suggest that for the soil of Malta, an EC1:5 value > 500 µS cm-1 would indicate a saline soil.

COVID-19 Public Signage: A Documentary Typology and Case Study of Malta

Dr Marc Kosciejew
Department of Library Information & Archive Sciences, Faculty of Media & Knowledge Sciences

Signs saturate and surround society. This poster illuminates the significant roles played by documentation within the context of the coronavirus pandemic. It centres, what it terms as, "COVID-19 signage" as essential extensions of nonpharmaceutical interventions (NPIs) into society. It posits that this signage helps materialise, mediate and articulate the pandemic from an unseen phenomenon into tangible objects with which people see and interact.

The coronavirus pandemic cannot be seen with the naked eye. It is, in many respects, an abstraction. Documents enable the virus to be seen and the pandemic to be an experienced reality. Specifically, COVID-19 signage materialises the disease and pandemic into tangible items that individuals interact with and see on a daily basis as they navigate society. From personal to environmental to community signs, these documents have come to mediate social life and articulate COVID-19 during this extraordinary health crisis. A material basis of a shared "pandemic social culture" is consequently established by and through this signage and its ubiquity.

The VB Probability – A Probabilistic Measure for Brain Functional Parcellations

Dr Kenneth Scerri | *Co-researchers:* **Ms Elene Balanzategui Olaso**; **Dr Claude Julien Bajada**
Department of Systems and Control Engineering, Faculty of Engineering

The human brain is a complex signalling network which is, till this very day, not well understood. The scientific community has put significant efforts in developing various measurement and imaging techniques aiming to obtain a deeper understanding of the brain. Said comprehension is envisaged to provide a broader knowledge of our cognitive ability but also contribute in the diagnostics and treatment of various neurological and behavioural conditions and diseases.

Traditionally, the brain has been divided into distinct regions with various sensory, cognitive and motor functions being predominantly attributed to some of them. Nevertheless, over the years, the idea of sharply defined edges has been questioned, with the hypothesis of smoother transitions among these regions gaining in popularity and consensus.

In order to study the boundaries in brain parcellations, the BoB Lab developed the Vogt-Baileys (VB) index. It used functional Magnetic Resonance Imaging (fMRI) to obtain a measure of the functional connectivity among all measurement locations and thus obtained graduated boundaries. It has been used to study preterm birth, memory associated structures, and healthy brain white matter.

Although proving useful, the VB index is subject to the noisy measurements inherent in fMRI. Thus in this work, the VB index is further developed based on Bayesian estimation and Markov Chain Monte Carlo (MCMC) methods, to provide a measure of certainty in the results obtained – resulting in a probabilistic rather than a deterministic parcellation. Initial results on synthetic data highlight its ability to demarcate brain regions even in the presence of noisy measurements.

face:LIFT – Draw Me a Face

Mr Aaron Abela

Department of Communications & Computer Engineering, Faculty of Information & Communication Technology

In many domains, ranging from law enforcement to entertainment applications, a common task is to sketch or modify a picture of a face. Drawing a face from a text description makes the process more powerful than just clicking buttons, but is much more challenging due to the variety of ways to express a desired facial property. When people draw faces based on descriptions, they naturally don't expect a full description at one go since the person providing the description is typically allowed to provide additional details and corrections based on his/her observation of the preliminary sketches being drawn. Thus, a description might begin with "A woman with blue eyes and dark hair" followed by "She is pale".

The face:LIFT project is about developing a text-to-image technology that emulates this capability, bringing together advances in computer vision and natural language processing. Existing AI models like StyleGAN are incorporated into a mobile app in order to allow users to generate faces based on sentences in an iterative and interactive way. A dataset to help with evaluating the application has been collected and the current challenge is to optimise the models for faster execution rendering a more responsive app. In the long run, the technology is likely to be of value in domains like forensic science and education.

Pioneers in Maltese Archives and Libraries

Dr Valeria Vanesio

Department of Library Information & Archive Sciences, Faculty of Media & Knowledge Sciences

This project aims to reconstruct the forgotten 20th-century history of the libraries and archives sector protagonists of the Maltese Archipelago. Although preliminary research has been done in the field of the 20th-century history of Maltese archives and libraries, a study of the essential role of individuals in this field in the late-colonial and post-Independence Malta is lacking. The 20th century gradually showed a contrasting relationship between the growth of bureaucracy and the management of paper flows and the poor condition of records on the island were also internationally reported. At the same time, even when the institutions lacked a rescue and management plan, the indefatigable work of individuals, behind the scenes or at the front line, led to save, recover and manage a big part of the documentary heritage and provide an early form of access up to today. The project will also question the role that these holding institutions played in preserving and shaping the national memory through the lens of the modern profession. This is an ongoing project which will yield results in a staggered manner at different moments. An online section in the platform and community archive Memorja has already been created including the first interviews; a public seminar has already been held in December 2022 and a journal article is now under peer review by Archives and Records. More interviews, archival research and an exhibition are planned this year.

Hospitaller Florence: People, Archives and Territory

Dr Valeria Vanesio

Department of Library Information & Archive Sciences, Faculty of Media & Knowledge Sciences

This project aims to offer a unique opportunity to gain knowledge on people, institutions, and archival records related to Malta and the Order of St John in Europe, with a special emphasis on the unexplored Hospitaller archives in Florence. It will also delve into the multiple historical and legal frameworks in which the documents were produced and preserved and the institutions involved in these dynamics. It aims to rediscover a rich but forgotten story of Tuscan-Maltese links through the use of the latest tools in the digital Humanities in collaboration with the Malta Study Center (Dr Daniel Gullo). This is an ongoing project which will yield results in a staggered manner at different moments. There is already a body of materials that has been digitised and placed online at www.vhmml.org. There will be a Florence Winter School in February 2024 to discover and study the archives and institutions of the Order of St John (RSSD Fund 2023) which wish to provide student and scholars with a unique opportunities to develop new skills related to archives and historical research, but while are also transferable to other areas. There have been, and there will be further reciprocal visits by state between the Archivio di Stato di Firenze and UM, leading to the exchange of idea and expertise towards a systematic and academic analysis of the records and institutions of Malta and the Order of St John in other Italian and European archives. A scheme of the prioral archive of the Order in Florence and an identification of the main institutions involved in its history have been already reconstructed as part of this project.

L-Università
ta' Malta

University of Malta
Msida MSD 2080

um.edu.mt