



*"Frontiers of Research: Connecting Minds, Creating Impact"*

# 3<sup>RD</sup> RESEARCH OFFICERS NATIONAL SYMPOSIUM

2026

12–13 August 2026 | Penang, Malaysia



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## PREFACE



It is with great honour and immense pleasure that I extend my warmest welcome to all delegates, keynote speakers, invited guests, sponsors, collaborators, and participants to the 3rd Research Officers National Symposium (ReONS 2026).

On behalf of the Malaysian Research Officers Society (MROS), I am proud to present this Programme and Proceedings Book, which reflects the collective aspirations, achievements, and scholarly contributions of our vibrant research community. ReONS has evolved into a premier national platform that brings together Research Officers, Science Officers, academics, researchers, postgraduate students, industry practitioners, policymakers, and strategic partners to exchange ideas, share innovations, and strengthen collaborations across disciplines.

The theme of ReONS 2026, "Frontiers of Research: Connecting Minds, Creating Impact," embodies the spirit of scientific exploration and collaborative excellence. In an era where global challenges demand

integrated and evidence-based solutions, research professionals play an increasingly important role in generating knowledge, advancing innovation, informing policy, and translating research outcomes into meaningful societal, environmental, and economic impact. Through this symposium, we reaffirm our shared commitment to fostering a culture of research excellence that contributes to the nation's sustainable development and global competitiveness.

This publication showcases the breadth and diversity of research undertaken by dedicated professionals from various institutions and sectors. The papers presented span multiple disciplines, highlighting not only scientific discoveries and technological advancements but also innovative approaches to addressing complex local and global issues. More importantly, these contributions demonstrate the invaluable role of Research Officers and Science Officers as catalysts for knowledge creation, innovation, and impactful research translation.

As President of MROS, I firmly believe that the strength of our profession lies in our willingness to collaborate, learn continuously, and embrace emerging opportunities. ReONS serves as more than an academic symposium—it is a platform for nurturing professional networks, inspiring future collaborations, strengthening research leadership, and empowering the next generation of research professionals. I hope every participant will seize this opportunity to engage in meaningful discussions, exchange experiences, and establish partnerships that extend well beyond the symposium.

I would like to express my deepest appreciation to the Organising Committee of ReONS 2026, the Scientific Committee, reviewers, session chairs, keynote and invited speakers, presenters, volunteers, sponsors, exhibitors, collaborating institutions, and every individual whose dedication and hard work have made this symposium a success. Your commitment and professionalism have been instrumental in ensuring the quality and impact of this event.

To all authors, thank you for your valuable scholarly contributions, which enrich these proceedings and strengthen Malaysia's research ecosystem. It is my sincere hope that the ideas, findings, and collaborations emerging from ReONS 2026 will inspire future discoveries, promote interdisciplinary partnerships, and contribute meaningfully towards addressing national priorities and global challenges.

May this symposium continue to serve as a catalyst for excellence, innovation, and impactful research for years to come.

I wish all participants a productive, rewarding, and memorable ReONS 2026.

Dr. Norfaryanti Kamaruddin  
President

Malaysian Research Officers Society (MROS)

## MESSAGE FROM THE CHAIRPERSON



In the name of Allah, the Most Gracious and Merciful

*Assalamualaikum Warahmatullahi Wabarakatuh.* Warm greetings to all ReONS 2026 delegates.

It is both my pleasure and honour to welcome delegates of the 3<sup>rd</sup> Research Officers National Symposium (ReONS 2026) in Universiti Sains Malaysia, a fitting venue given the university's APEX status and commitment to translate research into real-world sustainability.

This theme of this year's symposium, "Frontier of Research: Connecting Minds, Creating Impacts" reflects the passion and ambition in our career.

The symposium provides a key platform for our scientific and social sciences community to exchange ideas and gain valuable insights from different experts. The symposium also offers numerous network opportunities to build partnerships as well as catching up on the latest findings in multidisciplinary niches.

Hosted in USM for the first time, ReONS 2026 will feature eminent international keynote speakers, a benchmark in our global standards in research networking. Besides the norms of scientific conferences featuring oral and posters presentations, ReONS 2026 will premier a newly launched Innovation Exhibition Competition, a new platform to showcase innovative products of Research Officers and Post-graduate especially first-timers, ReONS 2026 is offering an inaugural Travel Grants to FIVE outstanding delegates, with a token of RM 1,000 each.

I would like to take this opportunity to thank the Malaysian Research Officers Society (MROS), in particular, Dr Norfaryanti Kamaruddin (President) for her confidence in allowing USM to host ReONS 2026. My grateful thanks to all Speakers, Presenters, Innovators, Judges and Session Chairs for their support. I would also like to extend my deepest gratitude to Professor Dr Habibah A. Wahab, USM's Deputy Vice-Chancellor of Research & Innovation, also an Advisor to ReONS 2026, for her support and guidance. Last but not least I would like to thank my Organising Committee Members for their full commitment and perseverance preparing for the symposium despite many challenges over the last six months.

Finally, I would like to thank our generous Sponsors, Exhibitors, and the Management of Sains@USM and the Division of Research & Innovation for financial and resources toward this meeting.

I wish everyone an insightful and meaningful symposium and an enjoyable stay in Penang.

Your Sincerely

Ts. Dr. Ahmad Shalihin Mohd Samin  
Chairperson  
3<sup>rd</sup> Research Officer National Symposium (ReONS 2026)

## About ReONS 2026

The 3<sup>rd</sup> Research Officers National Symposium (ReONS) 2026 marks another milestone in advancing research excellence, professional development, and interdisciplinary collaboration among the research community in Malaysia. The symposium is jointly organised by the Malaysian University Research Officers Society (MROS) and Universiti Sains Malaysia (USM) under the theme "Frontiers of Research: Connecting Minds, Creating Impact" is held on 12–13 August 2026 at the Auditorium Murad Mohd Noor, Sains@USM, Penang, Malaysia. ReONS 2026 serves as a national platform for the dissemination of research findings, knowledge exchange, and networking among researchers from diverse disciplines, institutions, and sectors.

This Abstract Book compiles 66 accepted abstracts presented during ReONS 2026, comprising 40 oral presentations and 26 poster presentations, across five multidisciplinary tracks: Biology & Chemistry, Physics & Engineering, Research Management & Social Sciences, Medical & Veterinary Sciences and Computer Sciences & Mathematics. Marking a significant milestone, ReONS 2026 welcomes Science Officers and postgraduate researchers for the first time, alongside Research Officers, broadening participation and fostering greater interdisciplinary collaboration within Malaysia's research community. In line with the symposium's commitment to environmental sustainability, this Abstract Book is published in a digital format as part of ReONS 2026's paperless initiative, promoting greater accessibility while reducing paper consumption and environmental impact. The abstracts presented in this volume reflect the diversity, quality, and innovation of research that advances scientific discovery, promotes sustainable development, and delivers meaningful impact to society.

The Organising Committee extends its sincere appreciation to all authors for their valuable contributions and to all participants for their support of ReONS 2026. We also express our heartfelt gratitude to our partner organisations, co-organising institutions, reviewers, plenary speakers, session chairs, sponsors, exhibitors, and volunteers for their invaluable support, dedication, and commitment towards the successful organisation of ReONS 2026.

We hope that this book will serve not only as a permanent record of the scientific contributions presented at ReONS 2026, but also as a valuable reference that inspires future research, strengthens interdisciplinary collaboration, and encourages the translation of knowledge into innovative solutions that benefit society. We trust that the ideas and discoveries shared through this symposium will continue to contribute to research excellence and foster innovation towards a more sustainable and knowledge-driven future.

Organising Committee  
3<sup>rd</sup> Research Officers National Symposium (ReONS) 2026  
Universiti Sains Malaysia

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## KEYNOTE SPEAKERS

### KEYNOTE SPEAKER 1



**Name:** Prof. Sr. Dr. Mastura Jaafar @ Mustapha

**Affiliation:** Acting Director & Deputy Director II, Research Creativity & Management Office (RCMO), Universiti Sains Malaysia

**Title for Keynote:** Empowering the People Behind Research: Building an Ecosystem for Excellence and Impact

**About Speaker:** Professor Sr. Dr. Mastura Jaafar is currently exercising the functions of Director of the Research and Creativity Management Office and is a faculty member in the Quantity Surveying Programme, School of Housing, Building and Planning. She has extensive experience in the construction industry and has made significant scholarly contributions to research in the built environment, with particular expertise in construction management and tourism development. She has received several prestigious recognitions for her research, including the Emerald Literati Network Highly Commended Award in 2007 and 2015, and the Emerald Outstanding Paper Award in 2023. In 2025, she was recognised among the World's Top 2% Scientists in the field of Economics and Business, with contributions spanning the subfields of Tourism and Building & Construction.

She currently serves as the Editor-in-Chief of the Journal of Construction in Developing Countries, where she is committed to advancing high-quality research and scholarly excellence in the built environment, particularly in developing countries.

### KEYNOTE SPEAKER 2



**Name:** Dr. Camille Piponiot-Laroche

**Affiliation:** Cirad and Universiti Putra Malaysia

**Title for Keynote:** Understanding tropical forest dynamics to inform sustainable management and conservation

**About Speaker:** Camille Piponiot is a forest ecologist, researcher at CIRAD, and Consultant Fellow at Universiti Putra Malaysia (UPM). She earned her PhD in Environmental Sciences from the University of French Guiana. Her research focuses on tropical forest dynamics, carbon cycling, and sustainable forest management in the context of climate change by combining long-term field observations, ecological modelling, and large-scale data analysis. Her work has contributed to

understanding the sustainability of timber production and its effects on biodiversity and carbon storage in Amazonian forests. More recently, she has expanded her research to encompass a wider range of ecosystems, including agroforestry systems, while integrating participatory modelling approaches that engage stakeholders in developing more effective and locally relevant strategies for ecosystem management.

## PLENARY SPEAKERS

### PLENARY SPEAKER 1



**Name:** Mr. Iznan Husainy bin Hasbullah

**Affiliation:** Cybersecurity Research Centre (CYRES), Universiti Sains Malaysia

**Title for Plenary 1:** Demystifying Cybersecurity to Safeguard Scientific Frontiers

**About Speaker:** Iznan H. Hasbullah holds a B.S. in Electrical Engineering from Rensselaer Polytechnic Institute (USA) and an M.S. in Advanced Computer Networks from Universiti Sains Malaysia (USM), where he is currently a Ph.D. candidate in the same field.

Prior to joining USM in 2010, Iznan built extensive industry experience as a Software Developer, R&D Consultant, Network Security Auditor and Chief Technology Officer. He currently serves as a Research Officer at USM's Cybersecurity Research Centre (CYRES), formerly the National Advanced IPv6 Centre (NAv6).

His primary research interests include telematics, IoT, network security, and next-generation network protocols. Outside of his academic and professional pursuits, Iznan's diverse interests span demography, aging society, psychology, history, computing, and emerging technologies.

### PLENARY SPEAKER 2



**Name:** Dr Mohd Fadzil bin Jamaludin

**Affiliation:** Centre of Advanced Manufacturing and Material Processing (AMMP Centre), Universiti Malaya

**Title for Plenary 2:** Printing the Future : A Cross-Disciplinary Tour of Additive Manufacturing

**About Speaker:** Dr. Mohd. Fadzil bin Jamaludin is a Research Officer at the Advanced Manufacturing and Materials Processing (AMMP) Centre,

Department of Mechanical Engineering, Universiti Malaya. His research spans advanced joining and additive manufacturing technologies, with particular focus on wire-arc additive manufacturing (WAAM), friction stir welding (FSW), and laser joining processes. His work explores microstructural evolution, metallurgical behaviour, and process optimisation in metal fabrication, alongside applications of FDM-based soft tooling in CAD/CAM-driven fixture and die design for industrial use.

Dr. Fadzil's broader interests extend to emerging applications of additive manufacturing, including digital heritage preservation and digital twin technologies. He also serves as Managing Editor of the International Journal of Advanced Manufacturing and Material Processing (IJAMMP), supporting scholarly publishing within the discipline. He remains actively engaged in interdisciplinary collaboration across manufacturing science and engineering.

## PLENARY SPEAKER 3



**Name:** Dr. Ismayadi Ismail

**Affiliation:** Universiti Putra Malaysia

**Title for Plenary 3:** Graphenated Carbon Nanotubes: Bridging 1D-2D-3D Carbon for Advanced Functional Systems

**About Speaker:** Dr. Ismayadi Ismail is a Research Officer at the Institute of Nanoscience and Nanotechnology, Universiti Putra Malaysia. After earning his doctoral degree with Distinction in Magnetic Materials in 2012, he pioneered advanced research in nanomaterials synthesis, electromagnetic interference shielding, and graphenated carbon nanotubes. Over an exceptionally productive career, Dr. Ismail has authored 194 peer-reviewed journal articles, published 9 scholarly book chapters and 1 book, filed 9 patents, and led 10 research grants as Project Leader while collaborating as a Co-Researcher on 32 additional funded projects. To advance these frontier technologies, he maintains a strong global scientific footprint through frequent international collaborations with researchers across Turkey, Japan, the UK, and beyond. As a dedicated mentor, he has successfully supervised 36 postgraduate and internship students. A recognized scientific leader, he serves as Technical Manager for ISO/IEC 17025 laboratory accreditation and Associate Editor for the NanoEra Journal, and Editor for the Malaysian Journal of Microscopy. Among his numerous accolades, Dr. Ismail received the prestigious 2016 National Public University Outstanding Administrator Research Award alongside multiple national innovation gold medals.

## PLENARY SPEAKER 4



**Name:** Ts. Dr. Norhayati Mohamed Noor, AMIChemE

**Affiliation:** Universiti Teknologi Malaysia

**Title for Plenary 4:** Strategic Innovation Scouting: Bridging Academic Research and Commercialisation Success

**About Speaker:** Ts. Dr. Norhayati Mohamed Noor is the Chief Strategic Officer (CSO) at the UTM Innovation and Commercialisation Centre and a Senior Research Officer. She holds a B.Eng in Chemical Engineering and an M.Eng in Bioprocess Engineering from UTM, and a PhD in Pharmaceutics from the UCL School of Pharmacy, UK. With over 20 years of R&D experience at the Institute of Bioproduct Development (IBD UTM), she specializes in colloidal drug delivery and cosmeceuticals, extensively publishing books, chapters, and articles, and presenting at local and international conferences. As CSO, she directs UTM's technology scouting, driving the transition of innovations from IP filing through to successful product commercialization. Dr. Norhayati actively drives commercialisation alongside her team, recently delivering a commercialised technology transfer training module to the Tech Transfer Office (TTO) at Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia. For her outstanding contributions, she was awarded the Gold Award – Anugerah Pentadbir PERTISAS (Research) in UTM on April 16, 2026.

## PLENARY SPEAKER 5



**Name:** Dr Fhataheya Buang

**Affiliation:** Universiti Kebangsaan Malaysia

**Title for Plenary 5:** Beyond Barriers: Mucoadhesive Polymer Design and Preclinical Invertebrate Models in Transmucosal Drug Delivery

**About Speaker:** Dr. Fhataheya Buang is a Senior Research Officer at the Faculty of Pharmacy, UKM, and a licensed, practicing veterinarian specializing in veterinary pharmacy education, pharmaceutics and pharmacology research, and preclinical safety assessment. She is also a

Research Fellow at Bioserasi Laboratory, ALAF-UKM, an ISO 17025 and OECD GLP accredited facility providing in vitro and in vivo biocompatibility and toxicology testing across diverse industries, including medical devices, pharmaceuticals, pesticides, and others. A productive researcher, she leads several externally funded projects and serves as a co-researcher on national and international grants totaling RM3.4 million, alongside reviewing for international journals. She has over 45 peer-reviewed articles, including book chapters published by Elsevier, with an h-index of 19 and over 1,200 citations. Dr. Fhataheya is the founder and lead inventor of HALOTAG technology, which won the Gold Award at MJIC 2026 and Silver Awards at both the BRICS–ASEAN International Innovation Competition 2025 and KLESF 2025, and recently secured prototype development funding as principal investigator from INOVASI@UKM to advance the innovation toward commercialization.

## PLENARY ABSTRACTS

### Plenary Speech 1 (Universiti Sains Malaysia)

Mr. Iznan Husainy Hasbullah

#### Demystifying Cybersecurity to Safeguard Scientific Frontiers

Iznan Husainy Hasbullah, Lokman Mohd Fadzil, Selvakumar Manickam

*Cybersecurity Research Centre (CYRES), Universiti Sains Malaysia, Penang, Malaysia.*

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Global collaboration and connected labs have practically erased the boundary between physical research and the digital world. Today, 'cyber' isn't just an IT headache — it is the digital nervous system of modern science. Everything from our lab sensors to our published papers depends on it. If we want our research to run smoothly and the output to be credible and impactful, we must prioritize keeping this digital ecosystem secure.

In this presentation, cybersecurity is demystified by omitting complex technical jargon and emphasizing core concepts universally applicable to all scientific disciplines. The classical C.I.A. Triad—Confidentiality, Integrity, and Availability—is examined and contextualized within the framework of daily scientific research. Intellectual property and sensitive datasets are protected by confidentiality protocols, the continuous availability of critical lab systems and cloud data ensures research continuity, while data integrity prevent digital corruption that result in losing years of scientific effort.

Building on this foundation, the Zero Trust framework is introduced – not as a rigid set of software tools – but as a practical operational mindset rooted in the principle of "never trust, always verify." By establishing standard secure digital practices and mindset, it is demonstrated how institutional networks and research data can be safeguarded from modern threats by simple operational habits, without hindering innovation or cross-disciplinary collaboration.

Ultimately, researchers across all fields are encouraged to perceive cybersecurity not as an administrative barrier, but as an essential scientific enabler. It is concluded that when basic digital hygiene and a Zero Trust approach are embedded into routine research workflows, new research frontiers can be confidently explored while the integrity and impact of scientific discoveries are securely preserved.

**Keywords:** cybersecurity, network security, zero-trust framework

### Plenary Speech 2 (Universiti Malaya)

#### Printing the Future: A Cross-Disciplinary Tour of Additive Manufacturing

Mohd Fadzil Jamaludin<sup>1\*</sup>, Farazila Yusof<sup>1</sup>, Yupiter H. P. Manurung<sup>2</sup>

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#### Background

Additive manufacturing (AM), popularly known as 3D printing, has evolved from a rapid-prototyping curiosity into a strategic pillar of Industry 4.0, with implications that reach far beyond the factory floor. Patient-specific surgical guides in hospitals, lightweight brackets in aerospace, and custom fixtures in research laboratories now share a common thread: they are built one layer at a time, from a digital model, on demand. This plenary offers an accessible, cross-disciplinary tour of AM for research officers from science, medical, and engineering backgrounds.

#### Result

The talk begins with a plain-language overview of the seven ASTM process families, using everyday examples to demystify the alphabet soup of FDM, SLA, SLS, SLM, DED, and WAAM, and to clarify what each technology can and cannot realistically do. It then turns to the Malaysian context: the maturing ecosystem of AM adoption in local universities, GLCs, and SMEs; national policy signals from MyDIGITAL and the New Industrial Master Plan 2030 (NIMP 2030); and the growing role of AM in medical devices, tooling, digital heritage, and green manufacturing.

#### Discussion

Drawing on ongoing work at the Advanced Manufacturing and Materials Processing (AMMP) Centre, Universiti Malaya, including wire-arc additive manufacturing (WAAM) of stainless steel and FDM-based soft tooling, the session illustrates how researchers can identify realistic entry points into AM within their own portfolios. It closes with a candid look at the practical barriers Malaysian researchers face (material qualification, standards, cost, and skills) and the collaborative opportunities these barriers create.

#### Conclusion

Attendees will leave with a clearer mental map of AM technologies, a sense of where Malaysia sits on the global stage, and concrete ideas for weaving AM into their research and service work.

**Keywords:** Rapid prototyping, additive manufacturing, green manufacturing, 3D printing



## Plenary Speech 3 (Universiti Putra Malaysia)

### Graphenated Carbon Nanotubes: Bridging 1D-2D-3D Carbon for Advanced Functional Systems

Ismayadi Ismail<sup>1\*</sup>

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#### Abstract

The limitations of single-dimensional carbon allotropes hinder the progress of next-generation multifunctional technologies. While 1-dimensional carbon nanotubes offer superior conduction, they suffer from poor surface interaction. 2-dimensional graphene provides high conductivity but is prone to restacking, and conventional 3-dimensional porous structures lack sufficient edge density. This presentation addresses these shortcomings by introducing graphenated carbon nanotubes (g-CNTs) as a transformative hierarchical hybrid. This unique architecture integrates the conductive backbone of 1D CNTs with the chemically active edge sites of 2D graphene foliates, forming an interconnected 3D aerogel network through sp<sup>2</sup>-sp<sup>3</sup> bonded junctions. The talk outlines a systematic development pathway, beginning with the synthesis and growth mechanism of g-CNTs using a floating catalyst chemical vapor deposition (FCCVD) method. We demonstrate that synthesis parameters, particularly hydrogen flow rate and temperature, critically govern the transition from pristine CNT bundles to dense graphene foliate structures. Using grapeseed oil as a sustainable precursor, we successfully tune the foliate density to maximize surface area and electron edge density. Moving from materials science to engineering, the presentation highlights the integration of g-CNTs into high-performance devices. In dye-sensitized solar cells, g-CNT counter electrodes exhibit superior electrocatalytic activity for the iodide/triiodide redox reaction, achieving higher photocurrent density (9.70 mA/cm<sup>2</sup>) and overall power conversion efficiency that surpasses pristine CNTs and competes with platinum-based electrodes. For electromagnetic interference (EMI) shielding, g-CNT silicone composites demonstrate absorption-dominated shielding effectiveness, with total shielding reaching up to 80 dB at 3 mm thickness and absorbing up to 90% of incident radiation across the X-band. Furthermore, we explore energy storage applications where g-CNT scaffolds decorated with transition metal dichalcogenides deliver exceptional specific areal capacitance (up to 131.2 mF cm<sup>-2</sup>) with robust mechanical flexibility. Additional potential in gas sensing and microwave patch antennas is also examined. This work establishes g-CNTs as a versatile platform that bridges the gap between fundamental carbon science and practical device engineering. By unifying 1D conduction, 2D surface chemistry, and 3D hierarchical porosity, this hybrid material fills critical performance voids left by isolated carbon allotropes. The results offer clear directions for material scientists, energy researchers, and electronics engineers, paving the way for scalable, next-generation functional systems.

## Plenary Speech 4 (Universiti Teknologi Malaysia)

### Strategic Innovation Scouting: Bridging Academic Research and Commercialisation Success

Norhayati Mohamed Noor<sup>1\*</sup>, Muhammad Arif Harun<sup>1</sup>, Ma Kalthum Ishak<sup>1,2</sup>, Mohd Zaidi Abd Rozan<sup>1,3</sup>, Noor Azurati Ahmad<sup>1,4\*</sup>

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#### Background

Universities produce significant research outputs, yet many innovations fail to reach the market due to limited market intelligence, weak industry linkages, and inadequate commercialisation support. Strategic innovation scouting addresses these gaps by connecting promising research with IP, funding, incubation, and industry support. Previous studies show that the ICCubeX model strengthens technopreneurship and accelerates lab-to-market translation through integrated commercialisation support (Harun et al., 2024; Muhamad et al., 2024; Ishak et al., 2025).

#### Method

This study adopts a qualitative single-case study to examine the Scout–Structure–Scale framework at the Universiti Teknologi Malaysia (UTM) Innovation and Commercialisation Centre (ICC) (Noack & Jacobsen, 2021). The framework comprises Scout (innovation identification), Structure (IP, TRL, and market assessment) (Zemlickien! & Turskis, 2022), and Scale (commercialisation outcomes through IP filings, spin-offs, and industry collaborations) to examine research translation from lab to market.

#### Result

UTM implements the Scout–Structure–Scale framework by identifying innovations through technology scouting and researcher engagement. Selected projects receive support in IP assessment, technology and market validation, commercialisation planning, mentorship, incubation, and industry engagement. These interventions have contributed to increased IP filings, commercialised technologies, industry collaborations, funding, and university spin-offs.

#### Discussion

Effective innovation scouting requires evaluating not only technical merit but also market demand, IP position, technology maturity, and commercial potential. The ICCubeX model addresses these needs through structured commercialisation stages, entrepreneurship training, TRL-based funding, mentorship, legal support, networking, and incubation. Studies by Harun et al. (2024), Muhamad et al. (2024), and Ishak et al. (2025) demonstrate that this integrated approach strengthens research commercialisation by fostering industry engagement, targeted incubation, and effective technology transfer.

#### Conclusion

Strategic innovation scouting provides universities with a systematic pathway for transforming research outputs into viable market solutions. Integrating proactive scouting with structured incubation, intellectual property management, funding, mentorship and industry collaboration can improve commercialisation outcomes and generate sustainable economic and societal impact.

**Keywords:** Innovation scouting, technology transfer, research commercialisation, university incubation, industry collaboration



## Plenary Speech 5 (Universiti Kebangsaan Malaysia)

### Beyond Barriers: Mucoadhesive Polymer Design and Preclinical Invertebrate Models in Transmucosal Drug Delivery

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#### Background / Introduction

A major challenge in transmucosal drug delivery lies in achieving prolonged mucosal residence time alongside controlled drug release. While non-ionic polymers offer excellent biocompatibility, their inherently poor mucoadhesive properties limit clinical utility. This work outlines a translational pathway to overcome this limitation, spanning molecular synthesis through alternative preclinical validation to contribute a more efficient screening option to existing pharmaceutical knowledge.

#### Result

We designed and synthesized advanced polymer derivatives via backbone modification using four distinct classes of functional groups: acryloyl, methacryloyl, maleimide, and divinyl sulfone moieties. Successful functionalization was confirmed by NMR and FTIR spectroscopy. An alternative, ethically aligned invertebrate model, alongside in vitro Caco-2 assays, was used to successfully screen and validate the biocompatibility and safety profiles of the developed excipients. Tensile testing of mucosal tissue demonstrated that formulations incorporating these synthesized functional groups exhibited significantly superior mucoadhesive performance compared to unmodified counterparts.

#### Discussion

These specific modifications enable the excipients to form strong covalent bonds with sulfhydryl groups present in mucosal mucins via physiological Michael-type addition. This strategic modification preserves the biocompatible nature of the host polymer while substantially enhancing its mucoadhesive capacity through covalent mucin interaction. Compared to traditional evaluation techniques, using an alternative invertebrate model addresses the global demand for ethical testing frameworks while maintaining rigorous preclinical validation standards for novel biomaterials.

#### Conclusion

Modification of non-ionic polymers substantially enhances mucoadhesion, while invertebrate-based preclinical screening represents an ethical advancement that complements this synthetic strategy for the future development of next-generation transmucosal delivery polymers.

**Keywords:** Mucoadhesion, polymer synthesis, invertebrate models, transmucosal drug delivery, alternative preclinical screening.

## Abstract Book of the 3rd Research Officers National Symposium (ReONS) 2026

The abstracts included in this volume were part of the 3rd Research Officers National Symposium (ReONS) 2026 cited on the cover and title page. Abstracts were selected and subjected to review by the Editors and Reviewers. The abstracts published in this abstract book reflected the work and thoughts of the authors and are published herein as submitted. The Publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

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PROGRAMME SCHEDULE

3rd RESEARCH OFFICERS NATIONAL SYMPOSIUM (REONS) 2026

Frontiers of Research: Connecting Minds, Creating Impact

12-13 August 2026, Sains@USM, Pulau Pinang, Malaysia

|                   |                                                                                                                                                   |                                                                                      |                                                                          |                                                                                                  |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| PROGRAMME         |                                                                                                                                                   |                                                                                      |                                                                          |                                                                                                  |
| TIME              | DAY 1: 12 AUGUST 2026 (WEDNESDAY)                                                                                                                 |                                                                                      |                                                                          |                                                                                                  |
| 0830 - 0930       | Registration/Arrival of Guests/Poster Setup                                                                                                       |                                                                                      |                                                                          |                                                                                                  |
|                   | Breakfast                                                                                                                                         |                                                                                      |                                                                          |                                                                                                  |
| 0830              | Arrival of Honourable Guests & Registration                                                                                                       |                                                                                      |                                                                          |                                                                                                  |
| 0930              | Arrival of USM Deputy Vice Chancellor (Research & Innovation)                                                                                     |                                                                                      |                                                                          |                                                                                                  |
| 1000 - 1050       | Opening Ceremony of ReONS 2026                                                                                                                    |                                                                                      |                                                                          |                                                                                                  |
| 1000              | Introduction Remarks by Emcee (Ms Zarirah Karrim Wani)                                                                                            |                                                                                      |                                                                          |                                                                                                  |
| 1005              | National Anthem "NegaraKu" & USM "Menara Ilmu" followed by USM Corporate Video                                                                    |                                                                                      |                                                                          |                                                                                                  |
| 1015              | Doa Recital                                                                                                                                       |                                                                                      |                                                                          |                                                                                                  |
| 1020              | Opening Speech by USM Deputy Vice Chancellor (Research & Innovation)                                                                              |                                                                                      |                                                                          |                                                                                                  |
| 1040              | Presentation of Souvenirs, Travel Grant Awards & Special Awards for PPQ Best Logos                                                                |                                                                                      |                                                                          |                                                                                                  |
| 1050              | Photography Session                                                                                                                               |                                                                                      |                                                                          |                                                                                                  |
| 1050 - 1110       | Break & Poster Viewing Session                                                                                                                    |                                                                                      |                                                                          |                                                                                                  |
|                   | Keynote & Plenary Session<br>Session Chair + Time Keeper (Ts. Dr. Ahmad Shalihin Mohd Samin + Ivy Tay Xiu Qing)<br>AUDITORIUM MURAD MUHAMMAD NOOR |                                                                                      |                                                                          |                                                                                                  |
| 1110 - 1130       | Keynote Speech 1: (Prof. Sr. Dr. Mastura Binti Jaafar@Mustapha)                                                                                   |                                                                                      |                                                                          |                                                                                                  |
| 1130 - 1200       | Plenary Speech 1: Mr Iznan Husainy Hasbullah (USM)                                                                                                |                                                                                      |                                                                          |                                                                                                  |
| 1200 - 1230       | Plenary Speech 2: Dr Mohd Fadzil bin Jamaludin (UM)                                                                                               |                                                                                      |                                                                          |                                                                                                  |
| 1230 - 1400       | Lunch & Poster Viewing Session                                                                                                                    |                                                                                      |                                                                          |                                                                                                  |
| 1400 - 1530       | Innovation Judging ( <i>Foyer Bilik Mesyuarat Utama</i> )                                                                                         |                                                                                      |                                                                          |                                                                                                  |
| 1400 - 1530       | Session 1: Biology & Chemistry<br>(AUDITORIUM MURAD MUHAMMAD NOOR)                                                                                | Session 2: Physics & Engineering<br>(AUDITORIUM A)                                   | Session 3: Research Management & Social Sciences<br>(AUDITORIUM B)       | Session 4: Medical & Veterinary (BILIK SEMINAR 1)                                                |
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| 1400 - 1415       | A0012 Mohamad Ezany Bin Yusoff (USM)                                                                                                              | A0108 Rafidah Ahmad (USM)                                                            | A0033 Azizul Azman (UTM)                                                 | A0075 Pei Yee Tan (MPOB)                                                                         |
| 1415 - 1430       | A0099 Yeoh Chee Beng (MPOB)                                                                                                                       | A0102 Roslina Hussin (USM)                                                           | A0027 Siti Nur Hafizah Soid (UTM)                                        | A0087 Nurul Saadah Binti Ahmad (UKM)                                                             |
| 1430 - 1445       | A0045 Zuhaili Idham (UTM)                                                                                                                         | A0129 Zuraihana Bachok (USM)                                                         | A0150 Syahaneem Mohamad Zainalabidin (UPM)                               | A0198 Mohamad Fuad Bin Mohamad Anuar (KKM)                                                       |
| 1445 - 1500       | A0036 Fatin Diana Abdul Munir (RISDA)                                                                                                             | A0051 Roslan Kamarudin (USM)                                                         | A0030 Siti Zulaiha Hanapi (UTM)                                          | A0096 Siti Farizwana Mohd Ridzwan (UKM)                                                          |
| 1500 - 1515       | A0054 Nordiana Hanim Mohd Nor (MPOB)                                                                                                              | A0159 Nurul Nafiqah Itam Sulaiman (UKM)                                              | A0066 Emmy Farha Alias (UPM)                                             |                                                                                                  |
| 1515 - 1530       |                                                                                                                                                   |                                                                                      | A0009 Norfaryanti Binti Kamaruddin (UPM)                                 |                                                                                                  |
| 1630 - 1900       | 1st MROS Award 2026 [Venue: Pelinggam Cahaya]                                                                                                     |                                                                                      |                                                                          |                                                                                                  |



## 3rd RESEARCH OFFICERS NATIONAL SYMPOSIUM (REONS) 2026

## Frontiers of Research: Connecting Minds, Creating Impact

12-13 August 2026, Sains@USM, Pulau Pinang, Malaysia

| PROGRAMME            |                                                                                                                                                            |                                                                                          |                                                                           |                                                                                |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| TIME                 | DAY 2: 13 AUGUST 2026 (THURSDAY)                                                                                                                           |                                                                                          |                                                                           |                                                                                |
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| 0830 - 0900          | Keynote Speech 2: Dr Camille Pioniot LaRoche (Fellow Consultant, UPM)                                                                                      |                                                                                          |                                                                           |                                                                                |
| 0900 - 0930          | Plenary Speech 3: Dr Ismayadi Ismail (UPM)                                                                                                                 |                                                                                          |                                                                           |                                                                                |
| 0930 - 1000          | Morning Tea Break & Poster Viewing Session                                                                                                                 |                                                                                          |                                                                           |                                                                                |
| 1000 - 1200          | Innovation Judging ( <i>Foyer Bilik Mesyuarat Utama</i> )                                                                                                  |                                                                                          |                                                                           |                                                                                |
| 1000 - 1200          | Session 1: Biology & Chemistry<br>(AUDITORIUM MURAD MUHAMMAD NOOR)                                                                                         | Session 2: Physics & Engineering<br>(AUDITORIUM A)                                       | Session 3: Research Management & Social Sciences<br>(AUDITORIUM B)        | Session 4: /2YŁjdzŭŠW {ÖλŠyŎŠ ƒ a I-úKŠYI-úλŎă (BILIK SEMINAR 1)               |
| t I-ŭI-ftŠt {ŠăăI2yă | Session Chair + Time Keeper<br>(Dr. Siti Aminah Ahmed + Annur Najihah Zamri)                                                                               | Session Chair + Time Keeper<br>(Ts. Dr. Khairul Rahmah Ayub +<br>Dina Anis Safiah Sakri) | Session Chair + Time Keeper<br>(Dr. Mohd Sukri Shafie + Ivy Tay Xiu Qing) | Session Chair + Time Keeper<br>(Dr. Siti Khadijah Mohd Bakhori + Teu Jing Wen) |
| 1000 - 1015          | A0132 Fairous Salleh (UKM)                                                                                                                                 | A0060 Khairudin Zakaria (TNBR)                                                           | A0018 Norkisme Zainal Abidin (UKM)                                        | A0093 Zaitul Iffa Abd Rasid (UTM)                                              |
| 1015 - 1030          | A0210 Aini Hasanah binti Abd Mutalib (UMT)                                                                                                                 | A0207 Tan Ying Jie (USM)                                                                 | A0144 Mohd Arif Mohd Sarjidan (UM)                                        | A0048 Nur Amirah Mohd Ali (UTM)                                                |
| 1030 - 1045          | A0189 Syafiq Bin Shahrudin (USM)                                                                                                                           |                                                                                          | A0204 Nurul Azwa binti Mohd Yunus (UTM)                                   | A0057 Zulkarnain bin Abd Karim (NIHM)                                          |
| 1045 - 1100          | A0024 Siti Norasikin Ismail (UMT)                                                                                                                          |                                                                                          | A0168 Siti Hajar Mohammad (UKM)                                           | A0135 Iszuanie Syafidza Che Ilias (UPM)                                        |
| 1100 - 1115          | A0235 Noor Liana Mat Yajit (UM)                                                                                                                            |                                                                                          | A0039 Noor Aklima Harun (UTM)                                             | A0114 Khairi Azhar Aziz (UNITEN)                                               |
| 1115 - 1130          |                                                                                                                                                            |                                                                                          | A0105 Ahmad Fadly Bin Jusoh (USM)                                         |                                                                                |
| 1200 - 1400          | Lunch & Poster Viewing Session (Final Judging)                                                                                                             |                                                                                          |                                                                           |                                                                                |
|                      | Plenary Session<br>Session Chair + Time Keeper ( Dr. Siti Zulaiha Hanapi + Mrs Siti Norhafizah binti Ahmad Tarmidzi)<br>AUDITORIUM MURAD MUHAMMAD NOOR     |                                                                                          |                                                                           |                                                                                |
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| 1430 - 1500          | Plenary Speech 5 Dr Fhataheya Buang (UKM)                                                                                                                  |                                                                                          |                                                                           |                                                                                |
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| 1500                 | Announcement of Best Presentation Awards (Oral & Poster) & Innovation Awards                                                                               |                                                                                          |                                                                           |                                                                                |
| 1515                 | Announcement of 4th ReONS 2028 Host                                                                                                                        |                                                                                          |                                                                           |                                                                                |
| 1530                 | Closing Remarks by The Chairperson of ReONS 2026                                                                                                           |                                                                                          |                                                                           |                                                                                |
| 1600                 | End of ReONS 2026                                                                                                                                          |                                                                                          |                                                                           |                                                                                |

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### LIST OF ORAL PRESENTATION

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| A0132                                               | Ni-Promoted WO <sub>3</sub> Catalysts for CO-Driven Two Step Thermochemical Hydrogen Production                                                                     |
| A0210                                               | Determining migratory bird species in Setiu by using passive acoustic monitoring as part of a locally led East-Asian Flyway for Acoustics (LEAFA) Project           |
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| A0180                                               | Development of an Antioxidant-Rich Freeze-Dried Tropical Fruit Snack Using I-Optimal Mixture Design                                                                 |
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| A0129                                               | Microstructural and Thermomechanical Investigation of Warpage in Glass Fibre-Reinforced Cyclo-Olefin Copolymer Semiconductor Trays                                  |
| A0051                                               | Influence of Copper Layer Thickness on Hardness Using Molecular Dynamic Simulation                                                                                  |
| A0159                                               | Improving the Hydrogen Storage Properties of LiAlH <sub>4</sub> Using Strontium Ferrite                                                                             |
| A0060                                               | Pilot Deployment and Performance Evaluation of an Intelligent Remote-Control Box for Smart Distribution Substations                                                 |
| A0207                                               | Characterization of All-Cellulose Composite film from Oil Palm Empty Fruit Bunch Dissolving Pulp as Potential Packaging Application                                 |

| Code                                                                | Title                                                                                                                                                                                           |
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| A0120                                             | Biochemical Characterization of Transglutaminase from the Mangrove-Derived <i>Bacillus</i> sp. CCBMMP212                                                                    |
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| Code                                                                | Title                                                                                                                                                                  |
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## ORAL PRESENTATIONS

### SYMPOSIUM TRACK 1: BIOLOGY & CHEMISTRY

#### Evaluation of Anti-adhesion Activity of Human Amniotic Membrane on Gram-positive Oral Bacterial Pathogens: An *in vitro* Study [Oral: A0012]

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#### Background

The human amniotic membrane (HAM) is a promising biomaterial in periodontal regeneration due to its anti-inflammatory and antimicrobial properties. However, bacterial adhesion to biomaterials remains a major challenge affecting clinical outcomes.

#### Objective

This study aimed to evaluate the anti-adhesion activity of HAM against selected Gram-positive oral pathogens.

#### Methods

An *in vitro* multimethod approach was employed to assess the adhesion of *Streptococcus mutans* and *Streptococcus sobrinus* on glycerol-preserved HAM. Bacterial adhesion was quantified using colony-forming unit (CFU) enumeration, while bacterial morphology and surface colonisation were examined using Field Emission Scanning Electron Microscopy (FESEM). The expression of adhesion-related virulence genes was analysed by quantitative real-time polymerase chain reaction (RT-qPCR). All experiments were performed in triplicate, and the data were analysed using one-sample Wilcoxon signed-rank test, with statistical significance set at ( $p < 0.05$ ).

#### Results

HAM exhibited lower CFU counts and reduced bacterial surface colonisation for both *S. mutans* and *S. sobrinus* compared with the cellulose control, as evidenced by decreased CFU counts and reduced surface colonisation observed under FESEM. RT-qPCR analysis showed a trend towards reduced expression of adhesion-related virulence genes in HAM-treated bacteria; however, these differences were not statistically significant ( $p > 0.05$ ).

#### Conclusion

HAM exhibits intrinsic anti-adhesion properties against key Gram-positive oral pathogens. These findings support its potential application as a bioactive scaffold in periodontal therapy, where it may enhance tissue regeneration while limiting bacterial colonisation.

**Keywords:** human amniotic membrane, anti-adhesion activity, oral pathogens, *Streptococcus mutans*, biofilm inhibition

#### From Industry Need to International Standard: Development and Standardization of a Total Chloride Determination Method for Edible Oils and Fats [Oral: A0099]

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#### Background

The presence of 3-monochloropropane-1,2-diol esters (3-MCPDE) in edible oils remains a major challenge for the oils and fats industry. As chlorine-containing compounds are recognised precursors in 3-MCPDE formation during refining, monitoring total chloride content (TCC) has become increasingly important. However, no internationally recognised method specifically applicable to edible oils and fats was available.

#### Objective

This paper describes the development and international standardisation journey of a TCC determination method for edible oils and fats, from its adaptation from ASTM D4929 Method B to its progression as ISO 25671 under ISO/TC 34/SC 11.

#### Methods

An oxidative combustion–microcoulometric titration method adapted from ASTM D4929 Method B was evaluated for suitability in palm oil and related oil matrices. Method performance was assessed through validation studies. Following successful evaluation, the method was proposed to ISO as a New Work Item Proposal (NWIP). Progress through the ISO standardisation process, including NWIP balloting, Working Draft (WD) development and Committee Draft (CD) preparation, was reviewed.

#### Results

The method demonstrated satisfactory analytical performance for palm oil and secondary oil matrices, supporting its suitability for routine TCC determination. The proposed ISO project received strong international support during NWIP balloting, obtaining 22 affirmative votes with no negative votes. Comments received during the NWIP and WD stages primarily involved scope clarification, terminology harmonisation and precision reporting. Following incorporation of these comments, the project advanced to the Committee Draft stage, with an international interlaboratory comparison study currently being planned.

#### Conclusion

This work demonstrates how an analytical method adapted for edible oil matrices can evolve into an international standardisation initiative through scientific validation, industry relevance and international collaboration. The ongoing development of ISO 25671 is expected to provide a harmonised approach for TCC determination in edible oils and fats.

**Keywords:** total chloride content, microcoulometric titration, ISO 25671; edible oils and fats, 3-MCPDE



## Phytochemical Screening and Recovery of Phenolic Compounds from *Piper betel* Leaves via Subcritical Water Extraction (SWE) [Oral: A0045]

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### Background

*Piper betel* leaves are rich in phytochemical compounds with potential antioxidant and antimicrobial properties, particularly phenolic compounds such as eugenol and hydroxychavicol. Conventional extraction techniques commonly require organic solvents and prolonged extraction time, resulting in environmental concerns and lower process sustainability. Subcritical Water Extraction (SWE) has emerged as a promising green extraction technology capable of modifying water polarity under elevated temperature and pressure conditions, enabling selective recovery of bioactive compounds from plant matrices.

### Objective

This study aims to perform phytochemical screening and chromatographic profiling of SWE-derived *Piper betel* leaf extracts using High Performance Liquid Chromatography (HPLC) and Gas Chromatography-Mass Spectrometry (GC-MS) analyses.

### Methods

Dried *Piper betel* leaves were extracted using SWE under selected extraction conditions. Preliminary phytochemical screening was conducted to identify the presence of major phytochemical groups in the extracts. HPLC analysis equipped with photodiode array detection was performed using eugenol and hydroxychavicol analytical standards for compound identification through retention time matching. The selectivity and purity of the extracted compounds were further evaluated using GC-MS analysis. Chromatographic profiles and mass spectra obtained from the extracts were analysed to identify major volatile and semi-volatile phytochemical compounds present in the SWE extracts.

### Results

Preliminary phytochemical screening indicated the presence of phenolic-rich compounds in the SWE extracts. HPLC profiling confirmed the presence of eugenol and hydroxychavicol through retention time matching with analytical standards. GC-MS analysis further supported the phytochemical profiling by identifying major volatile and semi-volatile compounds and providing insight into the selectivity and relative purity of the extracted compounds. Variations in SWE conditions influenced chromatographic peak intensity and compound selectivity, particularly at elevated extraction temperatures. The chromatographic profiles demonstrated the capability of SWE to selectively recover targeted phytochemical compounds using water as a green solvent system.

### Conclusion

The study demonstrates the potential of SWE as an environmentally friendly extraction approach for phytochemical recovery from *Piper betel* leaves. HPLC and GC-MS profiling provided important analytical insights into the selectivity and purity of phenolic compounds extracted using SWE, supporting future optimization and bioactivity evaluation studies.

**Keywords:** subcritical water extraction, *Piper betel*, phytochemical screening, HPLC, GC-MS

## Silicon-Mediated Biochemical and Structural Defence Responses in Rubber Seedlings Against White Root Disease Caused by *Rigidoporus microporus* [Oral: A0036]

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### Background

White root disease caused by *Rigidoporus microporus* severely affects rubber cultivation through progressive root deterioration and plant decline. Although silicon (Si) enhances plant resistance against pathogens, information regarding Si-mediated biochemical and structural defence responses in rubber seedlings remains limited.

### Objective

This study evaluated the effects of Si application on disease suppression, biochemical defence responses, and cell wall reinforcement in *Hevea brasiliensis* seedlings inoculated with *R. microporus*.

### Methods

The experiment was conducted under nursery conditions at Universiti Putra Malaysia using a randomised complete block design with three replications. Three-month-old rubber seedlings of clone RRIM 2002 received four Si concentrations (0, 0.5, 1.0, and 2.0 g seedling<sup>-1</sup>) using sodium silicate solution. Following a three-month of Si pre-treatment, seedlings were inoculated with *R. microporus* and monitored for eight months. The disease severity, biochemical defence responses, and root cell wall thickening were evaluated using disease scoring, spectrophotometric assays, liquid chromatography mass spectrometry, and transmission electron microscopy.

### Results

Higher Si application significantly suppressed white root disease development. Seedlings treated with 2.0 g Si recorded the greatest reduction in internal root rot severity (75.93%) and foliar disease severity (75.68%) compared with untreated inoculated seedlings. Higher Si treatment significantly increased peroxidase activity (3.11 unit mL<sup>-1</sup>), total phenolic content (0.21 mg GAE g<sup>-1</sup> fresh weight), and lignin content (3.90 mg LTGA g<sup>-1</sup>). Root cell wall thickness increased from 21–38 µm in untreated seedlings to 68–80 µm following Si application. Jasmonic acid was detected only in Si-treated seedlings, suggesting activation of Si-mediated defence signalling pathways. Correlation analysis showed root Si accumulation was negatively associated with disease severity indices ( $r = -0.70$  to  $-0.84$ ).

## Conclusion

These findings demonstrate that Si-induced suppression of white root disease is closely associated with enhanced biochemical defence activation and structural reinforcement of root tissues, supporting the production of healthier rubber planting materials and more sustainable rubber cultivation.

**Keywords:** *Hevea brasiliensis*, silicon, white root disease, biochemical defence

## Cytogenetic Insights into Meiotic Chromosome Pairing in Oil Palm (*Elaeis oleifera* × *E. guineensis*) Interspecific Hybrids [Oral: A0054]

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## Background

Interspecific hybridisation between *Elaeis oleifera* and *E. guineensis* (OxG) is employed in oil palm breeding to combine desirable agronomic traits such as reduced stem height, improved oil quality, enhanced carotene content, and disease tolerance. However, their commercial utilisation is often limited by reduced fertility, suggesting the presence of genomic incompatibilities between the parental species. Understanding chromosome pairing behaviour during meiosis is therefore critical for elucidating genome interactions that influence hybrid fertility and recombination.

## Objective

This study investigated homologous chromosome pairing behaviour during meiosis in OxG hybrids using complementary cytological and molecular cytogenetics approaches.

## Methods

Cytological analyses were conducted using flower buds collected from male inflorescences of OxG hybrids. Meiotic chromosome preparations were examined by phase-contrast microscopy to observed meiosis across all stages, with detailed pachytene observations performed to identify localised non-pairing regions. Meanwhile, genomic *in situ* hybridisation (GISH) using parental genomic DNA probes was carried out to distinguish the *E. oleifera* and *E. guineensis* genomes and evaluate homologous chromosome pairing during bivalent stage.

## Results

GISH analysis confirmed the formation of 16 homologous bivalents during meiosis I, demonstrating that chromosomes derived from two parental species were capable of pairing with their homologous counterparts. Despite this overall pairing, detailed pachytene analyses revealed localised non-pairing regions in hybrids derived from Colombian × Nigerian and Brazil/Panama × Yangambi genetic backgrounds. Occasional inversion loops were also observed, suggesting structural divergence between parental chromosomes that may influence recombination patterns.

## Conclusion

This study provides important cytogenetic insights into parental genome interactions during meiosis in oil palm interspecific hybrids. Understanding the chromosome behaviour in OxG hybrids could provide valuable cytogenetics knowledge to support future breeding strategies aimed at improving hybrid fertility and breeding efficiency in oil palm.

**Keywords:** Oil palm, interspecific hybrid, meiosis, chromosome pairing

## Ni-Promoted WO<sub>3</sub> Catalysts for CO-Driven Two Step Thermochemical Hydrogen Production [A0132]

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## Background

The extensive reliance on fossil fuels has driven atmospheric carbon dioxide (CO<sub>2</sub>) concentrations beyond 432 ppm in 2026, accelerating climate change. Transitioning to a hydrogen (H<sub>2</sub>) economy requires efficient production technologies, where two-step thermochemical water-splitting offers a sustainable pathway. However, this technology faces a critical bottleneck in catalytic performance, demanding advanced heterogeneous catalysts to overcome slow reaction kinetics.

## Objective

This study aims to develop a highly active Ni-doped WO<sub>3</sub> catalyst system for pure hydrogen production via a two-step thermochemical water-splitting cycle, specifically utilizing carbon monoxide (CO) as a novel reducing agent.

## Methods

Ni-doped WO<sub>3</sub> catalysts (3–25 wt.% Ni) were prepared via wet impregnation and characterized using XRD and XPS. Reduction behavior and H<sub>2</sub> production were evaluated via Temperature-Programmed Reduction (TPR) and Pulse Chemisorption Water Vapour (PCWV) using a Micromeritics Autochem II analyzer.

## Results

Optimal performance was achieved with 15 wt.% Ni/WO<sub>3</sub>, yielding an initial 17.6% H<sub>2</sub>. Nickel enhanced CO adsorption and accelerated deep reduction (WO<sub>3</sub> → WO<sub>2.72</sub> → WO<sub>2</sub> → W → WC). Optimizing conditions (750°C oxidation, N<sub>2</sub> carrier, 10 mL/min water vapor) increased H<sub>2</sub> yield to 32.1%. Prolonged CO exposure (≥15 min) at 850 °C formed an in-situ tungsten carbide (WC) phase and carbon as a byproduct. This generated crucial active sites, boosting H<sub>2</sub> output before converting to WO<sub>2</sub> during steam oxidation. The catalyst demonstrated robust stability over five redox cycles (250 water vapor doses).

## Conclusion

The 15 wt.% Ni/WO<sub>3</sub> catalyst stands as a highly stable and promising material for thermochemical hydrogen production, driven by the synergistic effects of nickel promotion and in-situ WC phase formation using CO as a reducing agent.

**Keywords:** Thermochemical water-splitting, hydrogen production, Ni-doped WO<sub>3</sub>, CO reduction, tungsten carbide

## Determining Migratory Bird Species in Setiu by Using Passive Acoustic Monitoring as Part of a Locally-led East-Asian Flyway for Acoustics (LEAFA) Project [Oral: A0210]

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### Background

Passive acoustic monitoring combined with automated species recognition enables monitoring of migratory birds across broad geographic scales, yet the performance of automated detectors remains poorly evaluated for many migratory species.

### Objective

The Locally-led East Asian Flyway Acoustics (LEAFA) network was established to develop a collaborative framework for acoustic monitoring across the East Asian–Australasian Flyway and to evaluate the reliability of BirdNET for migratory bird detection.

### Methods

Autonomous recording units were deployed across 17 sites in Indonesia, Malaysia, the Philippines, and Taiwan. Recordings were processed locally using BirdNET Analyzer, and regional partners independently reviewed BirdNET detections using audio clips and spectrograms before submitting validated datasets for centralized analyses. Species-specific logistic regression models were then developed to examine the relationship between BirdNET confidence scores and validation outcomes.

### Results

Preliminary analyses include 2400 recording hours, and 972 reviewed detections across 15 migratory bird species. For most species, the probability of a validated detection increased significantly with BirdNET confidence score, although the strength of this relationship varied substantially among species. Some species exhibited consistently high validation rates across a broad range of confidence scores, whereas others showed greater uncertainty and higher false-positive rates.

### Conclusion

These findings demonstrate that BirdNET performance varies among migratory bird species and that confidence scores should be interpreted in a species-specific context rather than relying on a universal threshold. More broadly, this study demonstrates how collaborative analyses within the LEAFA network can support standardized validation, improve confidence in automated species recognition, and enable scalable acoustic monitoring for migratory bird conservation across the East Asian–Australasian Flyway.

**Keywords:** *Migratory shorebirds, flyway, passive acoustic monitoring, semiautonomous*

## Comparative trends in river health using the Water Quality Index (WQI), Biological Water Quality Index (BWQI) and River Health Index (RHI) in the Sungai Muda basin [Oral: A0189]

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### Background

River health is influenced by interactions among physico-chemical water quality, physical habitat, biological communities and human activities. Although the Water Quality Index (WQI) is widely used to classify river water quality in Malaysia, it represents a time-specific physico-chemical condition and may not fully reflect biological responses or broader ecological integrity. Therefore, integrating WQI with the Biological Water Quality Index (BWQI) and River Health Index (RHI) can provide a more holistic understanding of temporal changes in river condition.

### Objective

This study compared river health trends in the Sungai Muda Basin between the 2023/2024 and 2025/2026 monitoring periods using WQI, BWQI and RHI and examined the relationships among these indices.

### Methods

A comparative assessment was conducted at eight sampling stations: M1, M2, M2A, M2B, M3, M3A, M4 and M5. WQI was calculated using dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, ammoniacal nitrogen, suspended solids and pH. Benthic macroinvertebrates were collected using a 500-µm dip net, identified and assessed using BWQI. RHI was calculated by integrating Chemical, Physical, Biological and Sociological sub-indices with respective weightages of 30%, 27%, 25% and 18%. Descriptive comparison and regression analyses were subsequently performed.

### Results

Mean WQI increased from 78.13 in 2023/2024 to 88.17 in 2025/2026, with all stations achieving Class II during the latter period. The largest improvement occurred at M2B, where WQI increased by 18.18 points. In contrast, mean BWQI decreased slightly from 4.83 to 4.59. BWQI improved at M1, M2 and M2A but declined at five other stations, indicating spatially uneven biological responses. Mean RHI increased from 75.39 to 83.98, with all stations classified as Category A, or very healthy, in 2025/2026. The largest RHI improvement was recorded at M5, with an increase of 20.02 points. Regression analysis showed a very strong relationship between RHI and WQI ( $R^2 = 0.999$ ), whereas the relationship between RHI and BWQI was very weak ( $R^2 = 0.0115$ ).

### Conclusion

The Sungai Muda Basin demonstrated substantial improvement in physico-chemical water quality and overall integrated river health. However, biological recovery was inconsistent and did not correspond directly with improvements in WQI and RHI. These findings demonstrate that WQI alone may not adequately represent ecological condition and support the integrated use of chemical, physical, biological and sociological indicators for river management. Continued biological monitoring and habitat-based investigations are required to identify factors limiting macroinvertebrate recovery.

**Keywords:** *River health index, water quality index, biological water quality index, river basin, river health assessment*



## Habitat Characteristics, Local Distribution and Conservation Notes on *Begonia rajah* in Terengganu, Malaysia [Oral: A0024]

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### Background

*Begonia rajah* Ridley is one of the most iconic Malaysian *Begonia* species and is endemic to Terengganu, Peninsular Malaysia. This species was first officially described by botanist Henry Nicholas Ridley in 1894, after being discovered in 1892 by a local collector in Terengganu, Malaysia. Despite its horticultural significance, little field-based information is available on its current distribution, habitat requirements and conservation status.

### Objective

To address these knowledge gaps, this study aims to provide field-based information on the ecology and conservation of *B. rajah*. The objectives are to document the distribution of *B. rajah* in Terengganu, assess its habitat conditions particularly microhabitat features such as canopy cover, environmental parameters and evaluate the extent of human disturbance within its natural environment.

### Methods

Field surveys were conducted at Bukit Maras, Terengganu during October and November 2025 using an opportunistic sampling approach targeting suitable microhabitats, including stream corridors, brooks, moist rock outcrops and boulders. Once the species was located, the data of number of individuals, canopy cover, temperature, relative humidity, light intensity and anthropogenic disturbance were recorded in 1m x 1m quadrats.

### Results

*Begonia rajah* was recorded at three sampling points within a single locality, exhibiting a highly localised and fragmented distribution. The species grew primarily on humus-rich, moss-covered moist rock outcrops and boulders. Habitat conditions were characterised by dense canopy cover (62.7–85.6%), high relative humidity (96%), low light intensity (0.10–1.42 klx) and a mean temperature of 26.2°C, indicating a cool, humid and shaded microenvironment. Flowering individuals and seedlings were recorded, confirming active reproduction during the study period. However, the species occurs within an actively managed agricultural landscape where vegetation clearing and herbicide application were observed, representing potential threats to habitat quality. A preliminary conservation assessment estimated an Area of Occupancy (AOO) of 4 km<sup>2</sup> and an Extent of Occurrence (EOO) of 0 km<sup>2</sup>, indicating that *B. rajah* qualifies as Critically Endangered under IUCN Criterion B.

### Conclusion

These findings provide the first detailed field-based account of the habitat ecology of *B. rajah* and establish an important baseline for future monitoring and site-specific conservation management.

**Keywords:** *Begonia rajah*, endemic, habitat assessment, ecology, conservation

## HPLC-UV/DAD Strategy for K-Carrageenan Detection and Quantification via 4-Aminobenzoic Ethyl Ester Derivatization [Oral: A0235]

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### Background

Carrageenans (CRG) are sulfated polysaccharides that inherently lack UV-active chromophores and pose a major analytical challenge, as they cannot be directly detected by conventional Ultraviolet-Diode Array High-Performance Liquid Chromatography (HPLC-UV/DAD).

### Objective

In this study, a novel chemical derivatization strategy is presented for the selective detection of kappa carrageenan (K-CRG).

### Methods

Derivatization using 4-Aminobenzoic Ethyl Ester (ABEE) as a chromophoric labelling reagent and will be analysed using the analytical HPLC–UV/DA. The analytical performance of the optimised HPLC–UV/DAD method was assessed through calibration using κ-CRG standards. All HPLC methods were validated following standard analytical validation procedures in accordance with the International Conference on Harmonisation ICH Q2 (R1) guidelines. The validation process systematically assessed key performance parameters, including linearity, sensitivity, accuracy, and precision to ensure the reliability and robustness of each method.

### Results

The feasibility of ABEE derivatization was systematically evaluated, enabling effective UV detection at a maximum absorption wavelength of 330 nm. Excellent linearity was observed over the concentration range studied, with a coefficient of determination (R<sup>2</sup>) of 0.9943. The limit of detection (LOD) and limit of quantification (LOQ) were calculated in accordance with ICH Q2(R1) guidelines using the standard deviation of replicate responses at the lowest concentration level exhibiting measurable variance and the slope of the calibration curve. The LOD and LOQ were determined to be 0.071 mg/mL and 0.215 mg/mL, respectively, indicating high method sensitivity. Precision was evaluated at each concentration level using replicate injections, with %RSD values of 3.07 indicating good instrumental repeatability.

### Conclusion

The resulting purified and labelled CRG further establishes a platform for its downstream utilization in advanced biomedical applications.

**Keywords:** *K-carrageenan*, HPLC–UV/DAD, ABEE derivatization, method validation, analytical chemistry



## SYMPOSIUM TRACK 2: PHYSICS & ENGINEERING

### Hardware Synthesis and Implementation Trade-Offs for Parallel-Pipelined-Memory Blowfish-128 Ciphers: An FPGA vs. ASIC Empirical Study [Oral: A0108]

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#### Introduction

Embedded edge-computing and Internet of Things (IoT) systems require optimized hardware-accelerated security frameworks to prevent cryptographic processing bottlenecks. To address these overheads, this study introduces an enhanced 128-bit Parallel-Pipelined-Memory (P<sup>2</sup>M) Blowfish architecture that expands block processing width and performance over the standard 64-bit Blowfish configuration.

#### Objective

To execute a comprehensive implementation analysis and evaluate explicit layout, speed, and power trade-offs between field-programmable gate array (FPGA) and application-specific integrated circuit (ASIC) nodes using an enhanced 128-bit P<sup>2</sup>M Blowfish block cipher design.

#### Methods

The proposed P<sup>2</sup>M Blowfish-128 core features dual 64-bit parallel execution blocks sharing four high-speed S-boxes inside an integrated memory layout to prevent resource redundancy. The processing pipeline incorporates 16 Feistel execution loops using XOR and addition networks with dedicated registers for stage synchronization. The system description was implemented in Verilog and verified via distinct flows. For the FPGA path, the design was synthesized onto ZedBoard Zynq-7000 using Xilinx Vivado. The ASIC path utilized Synopsys Design Compiler to map logic onto a 180 nm complementary metal-oxide-semiconductor (CMOS) node, followed by automated layout generation using Synopsys IC Compiler/Astro.

#### Results

Synthesis metrics reveal that the standard-cell 180 nm ASIC implementation drastically optimizes core complexity down to 273 dedicated logic gates (achieving an 84.3% layout size reduction over the FPGA's ~1,740 equivalent gate mapping), reducing processing latency to 5 cycles with a dynamic power footprint of 4.9 mW. Conversely, leveraged by its advanced transistor integration, the FPGA platform handles a higher clock frequency of 285.714 MHz, achieving a processing throughput of 6.095 Gbps. Comparative analysis indicates that the proposed core outperforms existing references: the FPGA implementation provides a 30% speed up over standard reference structures while utilizing 56% fewer slices and saving 94% more power. Correspondingly, the proposed ASIC design reduces power consumption and core gate count, outperforming existing state-of-the-art implementations by at least 34%.

#### Conclusion

The standard-cell ASIC approach serves as an efficient path for high-density, low-power industrial deployments by minimizing structural gate overhead, whereas the reconfigurable FPGA implementation exploits advanced lithography nodes to maximize processing throughput for real-time edge security primitives.

**Keywords:** P<sup>2</sup>M Blowfish-128; CMOS; FPGA; ASIC

### Recent Developments in Microcontroller-Based Dip Coating Automation for Advanced Structural and Film-Based Microwave Absorbers: A Review [Oral: A0102]

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#### Background

The widespread mitigation of electromagnetic radiation from diverse wireless equipment demands highly reliable microwave-absorbing materials (MAMs) tailored for modern electronic and aerospace applications. This study focuses on microcontroller-based automation methods used in the sol-gel dip coating of coating-based microwave absorbers, addressing the manual actuation errors and baseline speed fluctuations that cause structural non-uniformities and degrade wave attenuation metrics.

#### Objective

To provide a comprehensive technical overview of contemporary microcontroller architectures, digital communication interfaces, high-resolution kinematic actuators, and firmware control loops specifically configured for wave-absorber deposition, while mapping hydrodynamic analysis to electromagnetic interference criteria.

#### Methods

This study utilizes a technical review design, incorporating hydrodynamic analysis mapped to the classical Landau-Levich equation and quarter-wavelength electromagnetic interference criteria. It systematically compiles advanced multi-vessel automation strategies for layer-by-layer (LbL) gradient loss synthesis and evaluates recent mechatronic implementations.

#### Results

Architectures Evaluated: Contemporary microcontroller architectures including Arduino, STM32, and ESP32. State-of-the-Art Configuration: Integration of a dual-core 32-bit microcontroller unit (MCU)—specifically the ESP32 architecture—paired with a rigid dual planetary ball-screw drive. Operational Bottlenecks: Structural vibrational resonances at the meniscus line, non-Newtonian slurry handling, and the lack of real-time thickness feedback loops. Mitigation Paradigms: Forward-looking machine learning loop-tuning paradigms.

## Conclusion

Modern automated setups using advanced microcontrollers provide a highly reproducible method for engineering precise impedance-matched boundary layers for microwave absorbers. Future improvements depend on resolving meniscus-line vibrational resonances, handling non-Newtonian slurries, and integrating machine learning-driven real-time feedback loops.

**Keywords:** *Microcontroller-based automation; ol-gel dip coating; microwave-absorbing materials; Landau-Levich equation; layer-by-layer synthesis*

## Microstructural and Thermomechanical Investigation of Warpage in Glass Fibre Reinforced Cyclo-Olefin Copolymer Semiconductor Trays [Oral: A0129]

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## Background

Glass fibre reinforced cyclo-olefin copolymer (GF-COC) trays are widely used in semiconductor manufacturing owing to their excellent dimensional stability and thermal resistance. However, tray warpage during thermal exposure and long-term stacking remains a major reliability issue. Although thermal expansion is commonly associated with dimensional distortion, the roles of fibre orientation, mechanical stiffness and thermal expansion in tray warpage remain poorly understood.

## Objective

This study investigates the influence of tray geometry on fibre orientation, thermomechanical behaviour and warpage in an industrial injection-moulded GF-COC semiconductor tray.

## Methods

Representative specimens from different tray locations were characterised using FESEM, supported by EDX, together with DMA and TMA to evaluate fibre orientation, elemental composition, viscoelastic behaviour and thermal expansion.

## Results

FESEM revealed location-dependent fibre orientation, with thicker sections exhibiting aligned fibres and thinner sections showing increasingly random orientations. EDX confirmed uniform elemental composition, indicating that the observed microstructural differences arose from geometry-induced processing effects rather than material composition. Consistent with the FESEM observations, DMA showed reduced storage modulus retention in regions with disordered fibre orientation, indicating lower local stiffness. TMA revealed average secant CTE values of approximately  $116 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$  and  $217 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$  over 30–120°C, representing an 87% difference between representative tray locations. This variation is expected to generate thermal expansion mismatch during heating. As the operating temperature (121°C) remains below the glass transition temperature of the COC matrix (~130°C), thermal expansion alone cannot account for the observed warpage.

## Conclusion

Tray warpage is governed by the coupled effects of geometry-induced fibre orientation, mechanical stiffness and thermal expansion mismatch. These findings provide a scientific basis for optimising tray geometry and injection moulding parameters to improve the dimensional stability and reliability of semiconductor handling trays.

**Keywords:** *Fibre orientation, warpage, semiconductor tray, glass fibre reinforced cyclo-olefin copolymer (GF-COC)*

## Influence of Copper Layer Thickness on Hardness Using Molecular Dynamic Simulation [Oral: A0051]

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## Background

Copper is widely used in the electronics industry due to its excellent electrical and thermal conductivity. Understanding the mechanical properties of nanoscale copper films is essential for improving the reliability of electronic devices.

## Objective

This study investigates the effect of film thickness and substrate interaction on the hardness of copper thin films using experimental and simulation approaches.

## Methods

Nanoindentation tests were performed on pure copper and copper PCB films. Molecular dynamics simulations of copper films on silicon substrates were conducted using LAMMPS, with interfacial interactions modeled by the Lennard-Jones potential. OVITO was used for visualization.

## Results

Both experimental and simulation results showed that hardness increased as film thickness decreased. The highest hardness value of 1.818 GPa was obtained at a thickness of 12 nm, while the lowest was observed at 40 nm. The silicon substrate significantly enhanced the mechanical performance of the copper films.

## Conclusion

The findings demonstrate that thinner copper films exhibit higher hardness and that substrate interactions strongly influence their mechanical properties. These insights may support the design of more reliable electronic devices.

**Keywords:** *Copper thin film, nanoindentation, molecular dynamics simulation, hardness*

## Improving the Hydrogen Storage Properties of LiAlH<sub>4</sub> Using Strontium Ferrite [Oral: A0159]

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### Background

Hydrogen storage remains a primary bottleneck in the advancement of hydrogen-based energy systems. Among various solid-state materials, complex hydrides such as LiAlH<sub>4</sub> have attracted significant attention due to their notably high theoretical hydrogen capacity. However, their practical application is severely hindered by high dehydrogenation temperatures, sluggish sorption kinetics, and poor reversibility.

### Objective

This study aims to investigate the effect of SrFe<sub>12</sub>O<sub>19</sub> on the hydrogen sorption properties of LiAlH<sub>4</sub> and elucidate its catalytic role for solid-state hydrogen storage applications.

### Methods

The composite was synthesized via mechanical ball milling. The hydrogen sorption performance was evaluated using a Sieverts-type PCT apparatus, while the structural, morphological, and thermal properties were characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), and differential scanning calorimetry (DSC).

### Results

The incorporation of SrFe<sub>12</sub>O<sub>19</sub> significantly improved the dehydrogenation performance of LiAlH<sub>4</sub>. The onset desorption temperatures were drastically reduced from 140°C to 80°C for the first decomposition stage, and from 180°C to 135°C for the second stage. Furthermore, the 10 wt% SrFe<sub>12</sub>O<sub>19</sub>-doped sample released approximately 5.54 wt% of hydrogen within 20 minutes at 130°C, compared to a mere 0.3 wt% for the as-milled LiAlH<sub>4</sub> under identical conditions. Kinetic analysis confirmed a substantial reduction in the activation energies for both dehydrogenation stages. This enhanced performance is attributed to the in-situ formation of catalytically active Fe and LiFeO<sub>2</sub> species during the dehydrogenation process.

### Conclusion

These findings demonstrate that strontium ferrite (SrFe<sub>12</sub>O<sub>19</sub>) serves as a highly effective catalyst in overcoming the kinetic barriers of LiAlH<sub>4</sub>, providing a promising pathway for the development of advanced solid-state hydrogen storage systems.

**Keywords:** Light complex hydride; alanate; catalytic effects; solid-state storage

## Pilot Deployment and Performance Evaluation of an Intelligent Remote-Control Box for Smart Distribution Substations [Oral: A0060]

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### Background

Conventional Remote Control Boxes (RCBs) used in Distribution Network substations support only manual remote switching, require extensive multicore cabling, provide no real-time load monitoring and lack historical event traceability. This paper presents the development and validation of the Intelligent Remote-Control Box (iRCB), a digital solution that integrates RTU communication, real-time alarm monitoring and historical event logging to support smart substation operations.

### Objective

The project aims to enhance the existing Distribution Intelligent Switch (DIS) specification by incorporating iRCB functionalities to support TNB's Smart Substation, Digitalization and ESG initiatives. It also includes the development of supporting documentation for implementation, operation and maintenance.

### Methods

A design–develop–validate methodology was adopted at the DEC, SCADA Laboratory. The iRCB was successfully developed and validated through four functional tests — Point Status, Interlocking, Command Control and Analog Measurement — conducted across four RTU brands commonly deployed in TNB distribution substations.

### Results

All functional tests achieved a 100% pass rate across the four RTU platforms, demonstrating the readiness of the iRCB for field deployment. The tablet-based HMI, combined with real-time monitoring and historical event logging, reduces cabling requirements, improves switching efficiency and enhances operational traceability.

### Conclusion

The iRCB is recommended for deployment at selected Distribution Network substations. Future work will focus on expanding interoperability with additional RTU platforms and supporting wider implementation across the Distribution Network.

**Keywords:** Intelligent-Remote Control Box (iRCB), smart substation, Distribution Intelligent Switch (DIS), Remote Terminal Unit (RTU)

## Characterization of All-Cellulose Composite film from Oil Palm Empty Fruit Bunch Dissolving Pulp as Potential Packaging Application [Oral: A0207]

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### Background

The excessive reliance on petroleum-based plastic packaging has led to serious environmental challenges due to its non-biodegradable nature. Globally, there is an urgent need for sustainable packaging materials that can match the performance of conventional plastics while reducing environmental impact.

### Objective

This study explored the fabrication and performance of All-Cellulose Composite (ACC) films on the physicochemical, tensile, morphological, biodegradability and thermal properties derived from oil palm empty fruit bunch (OPEFB) for sustainable composite material.

### Methods

ACC films were prepared via a surface-selective dissolution approach with different initial cellulose concentrations at 1%, 3%, and 5% in 8% LiCl/N,N-dimethylacetamide (DMAc) solutions for 15 minutes.

### Results

The ACC 3% film showed the best balance properties, with a low tensile strength of 3.6MPa and highest elongation at break of 20.69%. Meanwhile, Differential Scanning Calorimetry and X-ray diffraction confirmed that the ACC 3% film possessed the highest melting temperature (T<sub>m</sub>), at 287.2°C, while cold crystallization temperature (T<sub>cc</sub>), at 241.3°C, with 28.48% crystallinity index. In soil burial tests, the film showed 67.35% weight loss within 8 days and cytotoxicity assays showed that cell viability of all films exceeding 50% indicates that they were non-toxic.

### Conclusion

These findings highlight the potential of ACC films from OPEFB, particularly the ACC 3% show the best performance as an alternative to petroleum-derived flexible packaging.

**Keywords:** *All Cellulose Composite, oil palm empty fruit bunch, biodegradable film, sustainable packaging*

## SYMPOSIUM TRACK 3: RESEARCH MANAGEMENT & SOCIAL SCIENCES

### The CONNECT Framework: A Strategic Approach by the Universiti Teknologi Malaysia (UTM) in Driving Industry-academic Collaboration and Research Impact [Oral: A0033]

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### Introduction

Bridging the gap between academic research and industrial need is essential for creating sustainable socio-economic impact. At Universiti Teknologi Malaysia (UTM), the Industry Network Unit (INU) serves as a strategic bridge, tasked with coordinating faculty experts and research centres to enhance industrial involvement. This initiative aligns with the "Frontiers of Research" theme by focusing on how connecting minds can lead to measurable development in the industrial sector.

### Objective

This study aims to present the CONNECT Framework as a systematic model for planning, coordinating, and mobilizing industry networking initiatives to strengthen the impact of research.

### Methods

This study evaluates the operationalization of the CONNECT framework by the INU through a structured case-monitoring methodology. The implementation process follows a rigorous four-stage procedure: (1) Initiation, involving opportunity mapping and targeted outreach to establish mutual goals; (2) Formalization, focusing on trust-building and executing agreements across 34 distinct collaboration types; (3) Execution, deploying trend-based joint industry-academic projects; and (4) Assessment, utilizing standardized Return on Value (ROV) and Return on Investment (ROI) metrics to monitor ongoing impact and ensure long-term sustainability.

### Results

The implementation of this framework by the INU has facilitated a structured approach to industry synergy. By focusing on long-term relationships and trend-based innovation, the framework allows for the execution of 34 distinct collaboration types. Effectiveness is measured through specific Impact Key Performance Indicators (KPIs), primarily Return on Value (ROV) and Return on Investment (ROI), ensuring that collaborations are both sustainable and ongoing.

### Conclusion

The CONNECT Framework provides a robust methodology for transforming academic expertise into industrial solutions. Its structured approach to nurturing and executing collaborations ensures that university research remains relevant to current trends, ultimately creating a lasting impact on industrial development.

**Keywords:** *CONNECT Framework, industry-academia synergy, research Impact, ROV*



## From Survival to Self-Belief: Psychological Well-Being as a Catalyst for Empowering Single Mothers and B40 Women through an Integrated Model [Oral: A0027]

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### Introduction

Single mothers and B40 women often experience financial instability, low self-confidence, and limited access to sustainable income opportunities. Existing empowerment programmes frequently focus on technical skills development while overlooking psychological readiness and emotional resilience, which are essential for long-term empowerment. To address this gap, the Integrated Socioeconomic Empowerment Model (ISEM) was developed as a holistic intervention that combines skills training, entrepreneurship development, spiritual-psychological support, and continuous mentoring.

### Purpose

This study aims to explore the role of psychological well-being in supporting the empowerment of single mothers and B40 women and to assess the effectiveness of the ISEM model as a holistic intervention for improving skills development, self-confidence, and socioeconomic empowerment.

### Methods

A mixed-methods study was conducted among 30 participants enrolled in the Knowledge Transfer Programme (KTP) NEXUS. Participants underwent a structured empowerment intervention comprising skills and entrepreneurship training, self-development activities, and continuous mentoring. Quantitative data were analysed using descriptive statistics in SPSS, while qualitative data were analysed using thematic analysis to explore participants' experiences and perceived empowerment outcomes.

### Results

The study comprised 30 participants, including single mothers and B40 women from the Johor Bahru and Kulai regions. Quantitative analysis demonstrated significant improvement, with mean scores increasing from 3.23 to 4.25 and an average attendance rate of 70.77%, reflecting sustained programme engagement. Qualitatively, thematic findings revealed enhanced self-confidence, emotional resilience, and entrepreneurial capability. These results indicate that psychological well-being serves as a catalyst, enabling participants to translate acquired skills into income-generating activities successfully.

### Conclusion

The findings suggest that integrating psychological well-being support with skills and entrepreneurship development may enhance empowerment outcomes among single mothers and B40 women. The ISEM framework provides a structured and scalable approach for promoting sustainable community transformation.

**Keywords:** *Community empowerment, psychological well-being, Integrated Socioeconomic Empowerment Model, single mothers and B40 women, Knowledge Transfer Programme*

## Nature-Based Aquaculture: Preliminary Insights from Malaysian Aquaculture Farmers [Oral: A0150]

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### Background

The Thirteenth Malaysia Plan (RMK13) emphasizes planetary health by strengthening sustainable development, environmental stewardship, and biodiversity conservation, including the application of nature-based solutions (NbS) to enhance ecosystem restoration and resilience. These priorities are aligned with the NbS framework, which integrates ecological processes into sustainable production systems to address environmental challenges. Within this context, nature-based aquaculture (NBA) represents an emerging approach to enhance aquatic food production while supporting ecosystem sustainability, climate resilience, and food security. However, the extent to which NBA is understood and implemented at the farm level remains limited.

### Objective

This study presents preliminary findings from ongoing Key Informant Interviews (KIIs) exploring marine aquaculture farmers' experiences, knowledge, and attitudes toward NBA.

### Methods

Six interviews were conducted with aquaculture farm managers, representing operations involved in both shrimp and fish production.

### Results

The insights reveal that while no interviewed farmers explicitly identify their operations as fully aligned with NBA, many intuitively implement practical, experience-driven sustainable practices and embedded climate adaptation strategies. Nevertheless, adoption is heavily constrained by severe economic pressures, mainly increasing input costs and strong market competition from lower-priced imports from Thailand and Indonesia. Crucially, these market pressures and implementation costs emerged as the dominant, recurring themes across all interviews, spontaneously raised by almost every informant. In contrast, awareness- and willingness-related factors surfaced only as minor concerns and were rarely perceived as principal roadblocks. With the absence of a market mechanism that financially incentivizes sustainability, farmer decision-making remains heavily dictated by cost efficiency and economic survival.

### Conclusion

These interviews demonstrate that the true bottleneck to NBA adoption is fundamentally structural and economic, rather than a lack of farmer interest or understanding. Therefore, this study recommends formalizing existing practices within a national NBA framework and promoting a stepwise approach in transitioning to NBA practices rather than demanding full adoption.

**Keywords:** *Nature-based solutions, nature-based aquaculture, ecosystem sustainability*

## The Strategic Role of Research Management and Administration in Bridging the Knowledge-Action Gap for Societal Well-being [Oral: A0030]

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### Background

In the global academic landscape, a significant "Knowledge-Action Gap" persists where vast amounts of data remain locked in technical silos or academic journals. Despite the existence of academic solutions, a gap often persists between academic knowledge and societal needs, leaving communities vulnerable. Research Management and Administration (RMA) is crucial for bridging this gap by translating knowledge into tangible benefits. RMAs achieve this through the strategic coordination of research, ensuring that evidence-based insights inform policy, innovation, and practical problem-solving.

### Objective

The study analyzes the shift in Research Management and Administration (RMAs) from traditional Performance Indicators to a high-impact social innovation. It proposes a framework for strategic university-government-industry-community-media collaboration to promote a sustainable, and competitive society.

### Methods

This study adopted a mixed-method institutional case study design using longitudinal data (2020–2025) from Universiti Teknologi Malaysia. Quantitative analysis of Knowledge Transfer Programme (KTP) records, funding allocations, and impact star ratings examined institutional support trends. Qualitative document analysis of the *UTM EnVision* 2021–2025 and ASCEND 2030 strategic plans mapped policy evolution, while a comparative analysis evaluated demand-driven versus supply-driven implementation approaches to strengthen R&D-driven community impact. Concurrently, the study evaluates an End-to-End Project Development Framework deployed by Research Management and Administration (RMA) professionals to bridge the theory-practice gap. This framework operationalizes impact and converts academic results into actionable insights for policymakers and society through a structured five-phase cycle: (1) Initiatives and Screening, (2) Planning and Quintuple Helix collaboration, (3) Implementation, (4) Monitoring and Control, and (5) Sustainable Strengthening.

### Results

Strategic research administration has shifted engagement from activity-based to outcome-oriented empowerment. Performance data shows that rigorous impact monitoring and ethical governance increased high-impact projects (3–5 stars) from 52 (2020) to 198 (2025). Furthermore, peak community empowerment (5-star rating) jumped significantly from 10 to 61 in the same period. These results proved that RMAs fosters collaborative ecosystems and enhances research literacy, ensuring trusted, adopted outputs with lasting societal impact.

### Conclusion

Specialized RMAs are essential for connecting university researchers with policymakers and the community, facilitating the translation of knowledge into societal benefits. The effectiveness of research management is measured by its success in promoting human dignity and social well-being through sustainable innovation.

**Keywords:** *Research management and administration, social innovation, knowledge transfer, community empowerment, community engagement, research impact, quintuple helix*

## Identifying Key and Strategic Sub-sectors in Malaysian Agriculture: An Input Output Analysis [Oral: A0066]

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### Background

Agriculture is an imperative sector for rural development and economic resilience in Malaysia. To maximize the socioeconomic impact of development policies, it is crucial to understand how agricultural sub-sectors interact with the broader economy. This study maps these critical inter-sectoral dynamics to identify structural gaps that lead to inefficient resource allocation and fragmented policies, hindering the sector from reaching its full potential.

### Objective

The primary objective of this study is to identify the most critical sub-sectors within Malaysian agriculture and evaluate their economic interdependence to guide targeted future growth.

### Methods

This study applies an Input-Output (I-O) framework to evaluate inter-sectoral interdependencies by calculating normalized backward linkages (BL) and forward linkages (FL) to classify sub-sectors based on their capacity to stimulate upstream production or support downstream supply chains.

### Results

The analysis reveals that 58% of sub-sectors function as independent industries (e.g., Food Crops, Vegetables, Rubber), meaning they are self-established within their own ecosystems but lack systemic economic spillovers. Consequently, resource use in these sectors remains isolated, limiting policy effectiveness across the wider supply chain. Conversely, Other Livestock emerges as the sole "key industry", acting as a powerful dual-action multiplier. Furthermore, Paddy and Oil Palm are identified as "strategic industries" due to exceptionally strong forward linkages, making them foundational resource suppliers for downstream industrial processing.

## Conclusion

To bridge these structural gaps, agricultural policy must shift from isolated sectoral funding toward integrated supply chain strategies. Structural transformation is urgently needed to transition independent sub-sectors into strategic or key industries. Policy recommendations include directing targeted investments into high-value-added processing, thereby optimizing resource efficiency to advance Malaysia's long-term food security and industrial sustainability.

**Keywords:** *Input-output analysis, economic linkages, key sector, structural transformation, Malaysian agriculture*

## From CSR to ESG: Developing and Validating a Practical ESG Implementation Framework for Malaysian Institutions and SMEs [Oral: A0009]

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## Background

The transition from Corporate Social Responsibility (CSR) to Environmental, Social and Governance (ESG) requires organisations to move beyond fragmented philanthropic activities towards measurable, accountable and strategically integrated sustainability practices. However, Malaysian institutions and small and medium enterprises (SMEs) often face resource, technical and governance constraints in translating established ESG standards into practical organisational actions. Existing frameworks are frequently designed for large corporations and reporting purposes, creating a need for a simplified, implementation-oriented framework appropriate to the Malaysian context.

## Objective

This study aims to develop and validate a practical CSR-to-ESG Implementation Framework for Malaysian institutions and SMEs. It addresses three questions: (1) What gaps hinder the transition from CSR activities to systematic ESG practices? (2) What components, indicators and assessment criteria are required for a practical ESG framework? and (3) Is the proposed framework relevant, clear and applicable to Malaysian organisations?

## Methods

A sequential mixed-method framework-development design will be employed. First, a systematic review and comparative mapping of established standards, including the GRI Standards, IFRS S1 and S2, Bursa Malaysia's Sustainability Reporting Guide, and the UN Sustainable Development Goals, will identify core ESG dimensions and indicators. Second, document analysis and semi-structured interviews with purposively selected representatives from Malaysian institutions and SMEs will identify implementation gaps and contextual requirements. The findings will be synthesised into a framework comprising four components: ESG governance and strategic integration; environmental and social performance; stakeholder engagement; and measurement, reporting and continuous improvement. Indicators will be assessed using relevance, measurability, feasibility and applicability criteria. The draft framework will subsequently undergo expert validation using a structured Delphi process and content validity assessment.

## Results

The study is still at the early stage and is expected to produce a validated framework, ESG indicator matrix, organisational readiness assessment criteria and practical implementation roadmap that enable organisations to progress systematically from CSR activities towards measurable ESG practices.

## Conclusion

The proposed framework will provide a context-sensitive bridge between international ESG standards and organisational implementation. The study contributes by transforming fragmented CSR practices into a structured and assessable ESG pathway, while supporting organisational decision-making, capacity building and evidence-informed sustainability policy in Malaysia.

**Keywords:** *Corporate Social Responsibility, ESG framework, SMEs, sustainability governance, ESG implementation, framework validation*

## Research Self-Efficacy Among Research Officers in Malaysian Public Universities [Oral: A0018]

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## Background

Research self-efficacy significantly influences an individual's ability to effectively execute core research activities. For research officers in Malaysian public universities, understanding their perceived capabilities is vital for driving institutional innovation, maintaining academic excellence, and optimizing overall research performance.

## Objective

This study evaluates the level of perceived self-efficacy among research officers across seven key dimensions: research planning, literature review, conducting research, data analysis, reporting, publication, and intellectual property (IP) and commercialization.

## Methods

A quantitative research design was employed utilizing a structured online questionnaire as the primary measurement instrument. A targeted sampling strategy focusing on research officers across Malaysian public universities was applied, successfully gathering data from 205 respondents. Self-efficacy levels and their variances were assessed using descriptive statistics, specifically mean, median, and standard deviation.



## Results

The cohort predominantly consisted of Research Officers (96.1%), with the highest representation from Universiti Teknologi Malaysia (25.9%) and Universiti Kebangsaan Malaysia (24.4%). Most respondents held a Master's degree (48.3%) and were involved in Physical Sciences and Technology (56.6%). Researchers exhibited high self-efficacy in technical execution; "conducting research" recorded the highest mean score (5.75) and lowest standard deviation (0.962). Conversely, the "IP and commercialization" dimension yielded the lowest results (mean = 4.75) and highest standard deviation (1.319), suggesting significant variance and comparatively lower confidence.

## Conclusion

While Malaysian research officers demonstrate high competence in fundamental research phases, a critical gap exists regarding IP and commercialization. Targeted training in IP management is necessary to bridge this competency gap and enhance the market impact of university research.

**Keywords:** *Self efficacy, researchers, IP, commercialization*

## Mapping Profiles and Bibliometric Analysis of Research Officers at Universiti Malaya [Oral: A0144]

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## Background

The future trajectory of Universiti Malaya (UM) as a prominent research institution is deeply intertwined with the expertise of its research workforce, particularly its Research Officers (ROs). As Malaysia adapts to globalization, there is a strong need to utilize human capital to produce impactful research and development (R&D) outcomes. ROs are specialized professional staff tasked with conducting R&D, managing grants, publishing scientific articles, providing expert consultancy, and fostering commercialization.

## Objective

The primary objective of the study is to provide in-depth insights into the roles, profiles, contributions, and impacts of ROs within academic institutions. The study aspires to serve as a reference point for the formulation and design of R&D policies and strategic initiatives in universities.

## Methods

The study utilized a multifaceted approach combining profile analysis and bibliometric analysis. Researchers evaluated the profiles of 70 ROs at UM, analyzing attributes such as gender, educational background, position, grade, and H-index. For the bibliometric analysis, data was extracted from the Scopus database for 58 ROs who had active profiles, focusing on the number of scientific publications, citation counts, and co-authorship patterns produced between 2018 and 2022.

## Results

The RO workforce at UM is predominantly female (66%), and the vast majority are highly educated, with 87% possessing postgraduate qualifications (Master's or PhD). Most ROs currently hold entry-level positions at grade 41. Bibliometric data showed a consistent upward trend in both publications and citations from 2018 to 2022, with a peak of 116 publications and 1,299 citations in 2022. The top three fields of research output were Engineering, Material Science, and Physics. Impact and Networking: UM's ROs demonstrated strong collaborative efforts, boasting a robust international network where 27% of their publications featured international affiliations. The most cited document produced by an RO during this timeframe garnered 209 citations.

## Conclusion

ROs have evolved to play a highly integrated and critical role in navigating the competitive academic landscape and driving UM's research programs. Their consistent scholarly output and diverse global collaborations make them a vital component of the university's research ecosystem. The authors conclude by recommending the establishment of RO placements within each faculty at UM to create a powerful synergy with academic staff, ultimately elevating the university's global research and innovation impact.

**Keywords:** *Research officers, roles, profiles, research impact, Universiti Malaya, Scopus, bibliometric analysis*

## A Preliminary Study on Students' Perceptions of Generative Artificial Intelligence in STEM Learning among Malaysian Secondary School and Higher Education Students [Oral: A0204]

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## Background

Generative Artificial Intelligence (GenAI) tools such as ChatGPT, Gemini and Microsoft Copilot are increasingly integrated into STEM education. While these technologies can enhance conceptual understanding, learning efficiency and student engagement, concerns remain regarding their responsible use and the evaluation of AI-generated information. Despite the growing adoption of GenAI, empirical evidence on Malaysian students' perceptions of its use in STEM learning remains limited. Understanding these perceptions is essential to support the ethical and effective integration of GenAI into STEM education.

## Objective

This preliminary study aims to examine Malaysian students' perceptions of Generative Artificial Intelligence in STEM learning.

## Methods

Guided by the Technology Acceptance Model (TAM), this quantitative cross-sectional study employed a self-administered online questionnaire using Google Forms among Malaysian secondary school and higher education students recruited through convenience sampling. The questionnaire measured eight perception constructs: conceptual understanding, learning efficiency, explanation of difficult STEM topics, learning engagement, ease of use, confidence in responsible AI use, verification of AI-generated information, and the future importance of AI in STEM education, using a five-point Likert scale. Descriptive statistics were used to summarise students' perceptions.



## Results

Preliminary findings indicate positive perceptions across all eight constructs. Respondents perceived GenAI as useful for improving conceptual understanding, learning efficiency, explaining complex STEM topics, enhancing engagement and being easy to use. Students also reported confidence in using GenAI responsibly, recognised the importance of verifying AI-generated information before academic use, and believed GenAI will play an increasingly important role in future STEM education.

## Conclusion

Preliminary findings suggest that Malaysian students perceive GenAI as a valuable tool for supporting STEM learning when used responsibly. The study provides early evidence supporting the integration of AI literacy, responsible AI use and critical evaluation of AI-generated information into STEM education. Future studies with larger, more representative samples are recommended to inform evidence-based educational policies and teaching practices.

## The Healthy-Sustainable Nexus: Assessing Healthy Lifestyle Practices and Environmental Consciousness Among Supporting Staff at a Malaysian Dental Faculty [Oral: A0168]

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## Background

Workplace wellness and campus sustainability are critical pillars of institutional management, yet their behavioral intersection, the healthy-sustainable nexus remains under-explored among institutional supporting staff.

## Objective

This study aimed to evaluate the relationship between healthy lifestyle practices, sustainable living behaviors and basic health metrics among supporting staff at a Malaysian dental faculty.

## Methods

A cross-sectional study was conducted among 92 active supporting staff members at the Faculty of Dentistry, Universiti Kebangsaan Malaysia. Participants were recruited via convenience sampling during a faculty wellness program. A mixed-methods approach was used, incorporating a self-developed pilot questionnaire and validated instruments. The questionnaire assessed physical health profiles, sustainable living and healthy lifestyles knowledge, attitude and practices (KAP). Data were analyzed using SPSS employing descriptive statistics and multiple linear regression. While Spearman's correlation was used to analyze the data and explore the interrelationships between these factors.

## Result

The sample predominantly comprised female staff (71.7%) and clinical personnel (63%). Clinical health profiles indicated high physical risk profiles with 72.8% classified as overweight and obese, 32.6% presenting with elevated blood pressure and 9.8% with diabetes. Healthy lifestyle practices were positively correlated with overall environmental consciousness ( $\rho=0.512, p<0.001$ ). Higher healthy lifestyle scores and sustainability literacy were both associated with increased

engagement in pro-environmental practices ( $\beta=0.548, p<0.001$ ). Elevated physical risk profiles were moderately associated with structural barriers such as a lack of time for physical activity ( $\rho=0.326, p=0.002$ ).

## Conclusions

The study highlights a strong relationship between personal health practices and environmental consciousness among dental supporting staff, as well as the significant role of daily health behaviors in fostering campus sustainability. Additionally, the findings suggest a clear intersection between individual physical wellbeing and structural institutional barriers, underscoring the need for tailored interventions to create unified enabling environments that promote both workplace wellness and sustainability goals.

**Keywords:** Sustainable living, healthy lifestyles, wellbeing, environment consciousness, dental

## Bridging Gaps in Mental Health Literacy: A Framework Driven AI Chatbot Mobile Application for B40 University Students in Malaysia [Oral: A0039]

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## Background

Mental health challenges among university students are rising globally, with B40 (low-income) students in Malaysia facing greater barriers due to stigma, limited access, and low mental health literacy (MHL). While AI chatbots offer scalable digital solutions, most lack grounding in structured MHL frameworks, limiting their ability to drive meaningful awareness and behaviour change.

## Objective

This study aims to design and develop an AI chatbot-enabled mobile application, guided by a mental health literacy framework, to support accessible and stigma-sensitive mental health education for B40 Malaysian university students.

## Methods

A design and development approach was employed to build a prototype mobile application integrating an AI chatbot developed using Flowise. The chatbot is structured using modular conversational flows and guided by a preliminary MHL framework, currently under refinement, encompassing symptom recognition, stigma reduction, self-help strategies, and help-seeking pathways. A functional prototype, including simulated dialogue and content mapping, has been developed. Planned evaluation includes a pilot study using pre- and post-assessment, user feedback, and interaction analytics.

## Results

The prototype demonstrates the feasibility of delivering structured, interactive mental health information through an AI chatbot interface. Initial system testing confirms coherent conversational flow and alignment with MHL components, indicating strong potential for user engagement and knowledge delivery.

## Conclusion

This ongoing work introduces a framework-driven AI chatbot approach for mental health literacy intervention. The proposed solution offers a scalable and inclusive model for digital mental health education, with potential to reduce access barriers among underserved student populations.

**Keywords:** *AI chatbot, mental health literacy, mobile application, B40 students, digital intervention*

## Optically Stimulated Luminescence Chronologies for Malaysian Archaeology: Positioning the Earth Material Characterization Laboratory, Universiti Sains Malaysia, as a Regional Archaeometry Hub [Oral: A0105]

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## Background

Establishing reliable chronologies for archaeological sites in Malaysia remains challenging due to rapid decomposition of organic materials in tropical environments, frequent disturbance of soil deposits, and the susceptibility of radiocarbon dating to contamination. These limitations hinder accurate reconstruction of Malaysia's archaeological history from the Palaeolithic period to historic settlements.

## Objective

This study aimed to highlight the application of Optically Stimulated Luminescence (OSL) dating for improving archaeological chronologies in Malaysia and to demonstrate the potential of the Earth Material Characterization Laboratory (EMCL), Universiti Sains Malaysia, as a regional archaeometry hub.

## Methods

A review of chronological data from major archaeological sites in Malaysia was conducted and evaluated alongside EMCL's analytical capabilities. The proposed workflow integrates OSL dating with complementary material characterization techniques using automated luminescence readers, darkroom facilities, X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FE-SEM), and Inductively Coupled Plasma Mass Spectrometry (ICP-MS/MS).

## Results

Evidence from archaeological sites, including Lenggong Valley and Bukit Choras, demonstrated that OSL dating is effective for determining the ages of open-air sediment deposits, ancient pottery, and historic architectural materials. The integration of chronological dating with geochemical and mineralogical analyses provides more comprehensive archaeological interpretations while reducing chronological uncertainties.

## Conclusion

The integration of OSL dating with advanced material characterization establishes EMCL as a strong candidate for a regional archaeometry hub. This integrated approach provides reliable chronological frameworks, strengthens technical support for archaeological research, and contributes to the advancement of heritage science in Malaysia.

**Keywords:** *Optically Stimulated Luminescence, OSL, archaeometry, geochronology, EMCL*

# SYMPOSIUM TRACK 4: MEDICAL & VETERINARY SCIENCES

## Nourishing the Gut: Effects of Red Palm Olein Biscuit Supplementation on Vitamin A-Deficient Children in Rural Malaysia [Oral: A0075]

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## Background

Vitamin A deficiency (VAD) remains a public health concern, particularly among children in low-resource settings. Emerging evidence suggests a bidirectional relationship between VAD and gut microbiota, whereby VAD may disrupt microbial diversity, while gut bacteria may, in turn, influence vitamin A metabolism and host nutritional status. However, clinical evidence supporting this interaction, particularly regarding provitamin A interventions and their effects on gut microbiota, remains limited.

## Objective

This study examined the effects of red palm olein (RPO) biscuit supplementation, a rich source of provitamin A carotenoids, on gut microbial profiles and associated health markers in vitamin A-deficient children.

## Methods

A double-blind, randomised controlled trial was conducted among 328 vitamin A-deficient children aged 8–12 years from rural Malaysia. Participants received either RPO biscuits (n = 145) or palm olein (PO) biscuits (n = 183) for 6 months. Stool specimens collected at baseline, 3 months, and 6 months were profiled by 16S rRNA gene sequencing and analysed using QIIME2 and R.

## Results

After 6 months, the RPO group demonstrated significantly greater abundances of potentially beneficial bacteria, including *Anaerostipes*, *Butyricicoccus*, and *Christensenellaceae R-7* group, relative to control group. These taxa correlated positively with improvements in alpha- and beta-carotenes, alpha-tocopherol, packed cell volume, and mean corpuscular volume ( $P_{adj} < 0.05$ ). Microbial network analysis further revealed greater community complexity and resilience in the RPO group, evidenced by higher average degree, higher clustering coefficient, and shorter average path length ( $P < 0.001$ ).

## Conclusion

This study demonstrated the potential of RPO biscuit supplementation in modulating gut microbiota of vitamin A-deficient children by enriching beneficial gut bacterial taxa which are linked to improvements in micronutrient and haematological markers, while also promoting greater microbial network cohesiveness. These findings suggest that provitamin A-rich RPO may serve as a practical food-based dietary strategy to support gut microbial balance and improve nutritional status in vulnerable populations.

**Keywords:** Vitamin A deficiency, red palm olein, gut microbiota, provitamin A carotenoids, randomised controlled trial

## Clinical Lipidomics in Bacterial Sepsis: A Systematic Review of Serum and Plasma Evaluations [Oral: A0087]

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## Background

Lipid metabolism plays a central role in host-pathogen interactions and immune regulation during bacterial sepsis, with its dysregulation contributing to organ failure and mortality. Blood-based lipidomics has emerged as a promising approach for identifying diagnostic and prognostic biomarkers in sepsis. However, discrepancies in lipid profiles between serum and plasma remain a major challenge for clinical translation.

## Objective

This systematic review synthesizes lipidomic evidence from serum and plasma in bacterial sepsis patients to identify reproducible lipid biomarkers, evaluate methodological heterogeneity and assess associations with clinical outcomes.

## Methods

A systematic search of five databases (Scopus, Pubmed, Ovid MEDLINE, Web of Science and Google Scholar) identified nine eligible studies published between 2016 and 2025 that applied untargeted or targeted lipidomics on human serum and plasma samples from adult bacterial sepsis patients (PROSPERO: CRD420251086177).

## Results

Across both matrices, reproducible candidate lipid biomarkers included triacylglycerols (TAG), phosphatidylcholines (PC), lysophosphatidylcholines (LPC), sphingomyelins (SM) and ceramides. Synthesized findings revealed characteristically distinct directional trajectories: consistent elevation of TAG, bidirectional shifts of PC, depletion of LPC, bidirectional shifts of SM and elevation of SM. Preliminary trend within the literature indicates that serum-based studies more frequently captured prognostic alterations, whereas plasma-based studies often focused on diagnostic discrimination. Substantial heterogeneity was observed in sample handling, lipid extraction protocols and analytical platforms.

## Conclusion

Overall, both matrices offer valuable clinical insights, though these apparent differences in diagnostic or prognostic utility may reflect primary study designs rather than intrinsic matrix superiorities. Methodological heterogeneity limits reproducibility, highlighting the need for standardized workflows to enable translation of sepsis lipid biomarkers.

**Keywords:** Sepsis, bacterial infection, lipidomics, serum, plasma, systematic review

## Monitoring Abuse and Violence Among In-school Adolescents: A Decade of Evidence to Support the INSPIRE Programme (2012–2022) [Oral: A0198]

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## Background

Abuse and violence against adolescents remain a major global public health and human rights concern. The World Health Organization (WHO) and partners advocate the INSPIRE framework programme while the United Nations Sustainable Development Goal (SDG) Target 16.2 to prevent and responding to violence against children and adolescents. Monitoring long-term trends in abuse and violence among adolescents is essential for evaluating progress, identifying vulnerable populations, and informing prevention strategies.

## Objective

This study examined decade-long trends in abuse and violence among in-school adolescents between 2012 and 2022 as well as factors association.

## Methods

A longitudinal analysis was conducted using National Health and Morbidity Survey (NHMS) collected in 2012, 2017, and 2022 among in-school adolescents. Abuse and violence with other adolescents' health components were assessed using standardized self-administered bilingual (Malay and English) questionnaires. Complex sample analysis was conducted to estimate the prevalence and logistic regression was used to identify associated factors using SPSS version 31.

## Results

Decreased trend was seen in the prevalence of violence among in-school adolescent; reducing from 35.9% (35.1%, 36.7%) in 2012 to 22.0% (21.1%, 22.9%) in 2022. Slightly reduced prevalence trend was also seen home abuse with 9.0% (8.5%, 9.4%) to 7.4% (6.9%, 7.9%). Surprisingly, verbal insult and abuses howed a stagnant prevalence with 41.9% (41.1%, 42.7%) in 2012 to 41.2% (39.7%, 42.6%) in 2022. Adolescents who undergo violence and abuse tends to involve risky lifestyles, lack of peer support and had issues in mental health.

## Conclusion

Despite mixed trends over the past decade, abuse and violence continue to affect a substantial proportion of in-school adolescents. These findings provide nationally representative evidence to inform implementation of the WHO INSPIRE framework and support progress towards achieving SDG Target 16.2 by guiding targeted, evidence-informed policies and interventions to prevent violence against children and adolescents.

**Keywords:** INSPIRE Programme, abuse, violence, adolescents, school



## Personal Dosimeter Non-adherence Among Multidisciplinary Medical Radiation Workers: A 15-year Synthesis of Global Evidence [A0096]

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### Background

Monitoring occupational radiation exposure via personal dosimeters is fundamental to healthcare safety. However, compliance rates among medical radiation workers (MRWs) vary widely across clinical settings.

### Objective

This study synthesises global literature to identify systemic gaps in dosimeter compliance and map the underlying behavioural, sociodemographic, occupational, and institutional factors driving non-adherence.

### Methods

A comprehensive synthesis was conducted on over 70 international reports (2008–2023) evaluating personal dosimeter adherence among multidisciplinary MRWs. Data were extracted, and thematic analysis was applied to categorise non-adherence rates, institutional barriers, and individual determinants across subspecialties.

### Results

Adherence rates differed starkly by subspecialty and individual profile. Radiology workers demonstrated the highest compliance (1% to 20% non-adherence), whereas orthopaedic, urologic, and dental practitioners reported critical non-adherence rates (60% to 100%). Within the clinical hierarchy, physicians and senior specialists exhibited significantly lower compliance rates than nurses and technologists, despite possessing higher baseline safety knowledge. Sociodemographic and occupational factors revealed non-linear trends across the literature. While some datasets linked younger, junior cohorts to superior compliance, others highlighted mid-career professionals or the most senior personnel as the most compliant. Gender differences were predominantly negligible, and organisational influence remained contradictory across geographic regions. Notably, higher academic qualifications did not correlate with increased compliance. Instead, targeted and formal radiation protection training emerged as the driver of good safety practices. Key institutional barriers included equipment non-availability, weak policy enforcement, and a lack of exposure feedback. Individual barriers included forgetfulness, physical discomfort, and an institutional fear of work restrictions if exposure limits were visibly exceeded.

### Conclusion

Dosimeter non-adherence is an organisational and occupational-cultural issue rather than a knowledge or educational issue. Bridging this gap requires moving away from generic academic training and passive dose tracking. Transitioning should target speciality-specific workplace cultures, mandate strict institutional policies, and provide regular, non-punitive exposure feedback loops.

**Keywords:** Radiation dose tracking, medical radiation workers, non-adherence, occupational radiation monitoring, passive dosimeter

## SYMPOSIUM TRACK 5: COMPUTER SCIENCE & MATHEMATICS

### Digitalising Research Ethics Administration Using Low-Code Technology: A Case Study of Universiti Teknologi Malaysia [Oral: A0093]

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### Background

Research ethics review is an essential component of responsible research conduct. At Universiti Teknologi Malaysia (UTM), research ethics applications are managed through a combination of online forms, email communication, spreadsheets, and manual tracking processes. As application volumes increase, these fragmented workflows may create administrative challenges, including difficulties in monitoring application progress, coordinating reviews, and managing communication among stakeholders. In line with the university's digital transformation agenda, a project was initiated to explore the use of low-code technology to support a more integrated research ethics administration process.

### Objective

This study aimed to identify the functional requirements for a digital research ethics management system and to develop a prototype solution using low-code technology based on the operational needs of the UTM Research Ethics Committee (UTM REC).

### Methods

A case study approach was employed. Requirement analysis was conducted through workflow reviews and stakeholder engagement sessions involving ethics applicants, reviewers, secretariat personnel, and the committee chair. Existing processes were mapped to identify operational challenges and user requirements. The identified requirements were translated into system functions and use cases. A comparative evaluation of low-code platforms was subsequently undertaken based on usability, scalability, security, compatibility with existing infrastructure, and cost considerations. A prototype system was then developed using the selected platform.

### Results

The requirement analysis identified four primary stakeholder groups, namely applicants, reviewers, secretariat personnel, and the committee chair. Fourcore modules were defined to support research ethics administration: Application Management, Secretariat Management, Document Evaluation, and Decision-Making. A total of thirteen use cases were developed to represent the end-to-end ethics review process. Key functional requirements included online application submission, reviewer assignment, document evaluation, meeting coordination, automated notifications, application tracking, and decision management. Following platform evaluation, Google App Sheet and Google



Apps Script were selected due to their compatibility with the existing institutional ecosystem and low implementation cost. A functional prototype was successfully developed to demonstrate the feasibility of digitalising research ethics administration using a low-code approach.

### Conclusion

The study provides a structured approach for identifying system requirements and developing a low-code solution to support research ethics administration. The findings demonstrate that low-code technology offers a practical and accessible platform for digital transformation initiatives within research management offices. The resulting prototype provides a foundation for future system testing, evaluation, and institutional implementation.

**Keywords:** *Research ethics administration, low-code technology, digital transformation, requirement analysis, research management*

## Preventing Temporal DoS Vulnerabilities in IPv6 Link-Local Networks Using an Enhanced Trust-Based Security Mechanism [Oral: A0195]

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### Background

IPv6 adoption is accelerating globally, replacing IPv4 due to address exhaustion. The Neighbor Discovery Protocol (NDP) is fundamental for IPv6 link-local communication but lacks robust security, exposing networks to insider threats and denial-of-service (DoS) attacks. Secure Neighbor Discovery (SEND) offers protection but is complex and unsuitable for resource-constrained devices. Trust-ND, a lightweight trust-based alternative, improves efficiency but suffers from temporal DoS vulnerabilities due to its timestamp design relying on local system time.

### Objective

This study aims to enhance Trust-ND by redesigning its timestamp mechanism to prevent temporal DoS vulnerabilities in IPv6 link-local networks without increasing computational or bandwidth overhead.

### Methods

We developed eTrustND, which replaces the local system clock with Coordinated Universal Time (UTC) as the timestamp reference, adopts an epoch-based integer format with higher precision by expanding the timestamp field from 32 to 48 bits using reserved packet space, and introduces a rule-based timestamp validation mechanism to handle unsynchronized clocks and prevent replay and timing-based DoS attacks. The methodology involved protocol design, implementation, and experimental evaluation using the Duplicate Address Detection (DAD) process in a controlled IPv6-only testbed.

### Results

Experimental evaluation showed that eTrustND maintains processing time and bandwidth overhead comparable to Trust-ND while achieving a 100% success rate in preventing temporal DoS attacks, even under scenarios with time zone discrepancies between devices. The enhanced timestamp precision and validation rules effectively eliminate vulnerabilities inherent in the original Trust-ND protocol.

### Conclusion

eTrustND offers a practical and scalable improvement to trust-based IPv6 link-local security by mitigating temporal DoS vulnerabilities without compromising performance. This advancement is particularly relevant for networks with resource-constrained devices. Future research may explore its applicability in IoT environments and investigate other potential Trust-ND vulnerabilities.

**Keywords:** *IPv6, denial-of-service, link-local network, network security, trust-based protocol*

## An Integrated Research Data Using Visual Analytics Workflows for Scalable Analytics and Data Driven Decision Making [Oral: A0048]

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### Background

Research universities manage diverse data, including publications, grants, innovations, and researcher profiles. In many institutions, these data are distributed across multiple systems and still require manual handling, which can be time consuming and prone to inconsistencies. As a result, their potential to support timely and informed decision making is often not fully realised. This study adopts a low code, workflow based visual analytics approach to enable more efficient and scalable research data integration.

### Objective

This study aims to develop and implement an integrated research data pipeline using visual analytics workflows to improve data integration, reporting efficiency, and decision making support in a university environment.

### Methods

An integrated data pipeline was developed using KNIME Analytics, a platform that supports workflow based data processing through a visual, node driven interface. The system integrates data from various internal systems and external sources, such as publication databases, into a unified workflow. The pipeline automates key processes including data extraction, cleaning, transformation, and consolidation. To ensure sustainability, the workflows were designed to be modular and reusable, allowing for easier maintenance and future extension. Data validation and governance steps were embedded within the workflows to maintain data accuracy, consistency, and traceability.

### Results

The implementation of the KNIME Analytics workflow significantly improved data processing efficiency by reducing processing time from approximately 4hours to 10 minutes (a 95.8% reduction). The automated workflow replaced hundreds of manual processing steps with a single integrated and reproducible workflow, resulting in higher productivity, reduced human error and improved process consistency and repeatability. Consequently, reporting timelines improved from several days to near real-time updates. The consolidation of data within this unified workflow environment enabled more consistent generation of research performance indicators, while automated validation minimized data discrepancies. The system also enhanced the visibility of research outputs, supported more effective monitoring of key performance metrics and through its visual workflow design, made advanced data analytics more accessible to users without programming expertise.

## Conclusion

Overall, the findings suggest that a low code visual analytics approach offers a practical way to enhance research data management in universities. By improving efficiency, data quality, and accessibility, it provides stronger support for evidence based decision making and institutional research governance.

**Keywords:** *Research data pipeline, visual analytics workflows, data integration, research management, decision making*

## The Systemic Lens: Integrating Systems Thinking in Qualitative Analysis to Solve Hospital Information System Data Quality Issues [Oral: A0057]

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## Background

Complex healthcare environments require a broader sociotechnical lens to fully understand multi-layered challenges. To address this, Inductive Systemic Analysis (ISA)—an innovative methodology that combines grounded theory with systems thinking—was introduced to explore the elements, interconnections, processes, and purposes of complex social environments. This study uses the Ministry of Health Malaysia's Hospital InformationSystem (HIS) data quality project as a practical manifestation of the systemic complexity that ISA aims to decode.

## Objective

To explore HIS data quality issues in Ministry of Health hospitals using ISA.

## Methods

The study analysed the HIS data quality issues through the ISA framework. This involved 17 Focus Group Discussion (FGD) and 11 In-depth Interview (IDI) sessions. To map complex causality and feedback mechanisms within the environment, the methodology utilized causal loop diagrams that were derived from the thematic coding, utilising systems thinking approach.

## Results

Using ISA framework revealed that data incompleteness is not an isolated human error, but rather an emergent behaviour shaped by issues such as poor software interoperability, inadequate vendor maintenance, and rigid system configurations. The analysis demonstrated that work pressures and structural limitations could lead HIS users to adopt unintended practices, such as copy-pasting clinical notes and circumventing mandatory ICD-10 coding using free-text entries. Furthermore, the causal loop diagrams highlighted how human reluctance, hardware limitations, and systemic design continuously interact and loop to erode overall data trust.

## Conclusion

Framing the HIS project through these systemic concepts suggests that resolving healthcare data quality issues requires "zooming out" to transform the entire sociotechnical ecosystem. Ultimately, this validates ISA as a vital and highly applicable tool for understanding and resolving intertwined organizational complexities.

**Keywords:** *Inductive Systemic Analysis (ISA), qualitative research, systems thinking, data quality, hospital information system*

## Adaptive Nonparametric Kernel Density Estimation for Modelling Three-Hourly Rainfall Distributions in Southern Peninsular Malaysia [Oral: A0135]

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## Background

Accurate modelling of rainfall distributions is fundamental for hydrological analysis, flood forecasting, and water resource management. In tropical regions such as southern Peninsular Malaysia, rainfall exhibits substantial temporal variability, positive skewness, and complex distributional characteristics that often violate the assumptions of conventional parametric probability distributions. Although parametric models such as the Normal, Gamma, Lognormal, Pearson Type III, Log-Pearson Type III, and Gumbel distributions are widely used in rainfall frequency analysis, their performance may be limited when modelling highly irregular rainfall behaviour. Nonparametric kernel density estimation (KDE) provides a flexible, distribution-free alternative capable of capturing complex rainfall distributions without imposing predefined distributional assumptions. This study evaluates the applicability of KDE for modelling three-hourly rainfall precipitation in southern Peninsular Malaysia.

## Objective

This study aims to evaluate the performance of nonparametric kernel density estimation in modelling three-hourly rainfall distributions across southern Peninsular Malaysia and to compare its performance with commonly used parametric probability distributions in representing tropical rainfall characteristics.

## Methods

Three-hourly rainfall precipitation data collected from eight rain gauge stations located in Negeri Sembilan, Melaka, and Johor were analysed. Rainfall probability density functions were estimated using three kernel functions: rectangular, triangular, and Gaussian. The bandwidth (smoothing parameter) for each kernel was determined using the Adamowski criterion. The resulting nonparametric density estimates were compared with previously fitted parametric probability distributions, including the Normal, two- and three-parameter Lognormal, two-parameter Gamma, Pearson Type III, Log-Pearson Type III, and Gumbel (Extreme Value Type I) distributions. Model performance was evaluated based on goodness-of-fit and the ability to accurately represent the observed rainfall distributions.

## Results

The nonparametric kernel density estimation models successfully represented the complex distributional characteristics of three-hourly rainfall across the eight study stations. Compared with the conventional parametric distributions, KDE provided greater flexibility in modelling skewed and heterogeneous rainfall patterns without requiring assumptions regarding the underlying probability distribution. Among the three kernel functions evaluated, the Gaussian kernel consistently produced the smoothest and most representative density estimates for most stations, demonstrating superior capability in capturing the variability of tropical rainfall.

## Conclusion

The findings demonstrate that nonparametric kernel density estimation is a robust and flexible alternative to conventional parametric probability distributions for modelling tropical rainfall. By accurately representing complex rainfall distributions, KDE offers valuable support for rainfall frequency analysis, hydrological modelling, flood risk assessment, and water resource planning. Future studies may further improve the methodology through adaptive bandwidth selection and integration with rainfall prediction models.

**Keywords:** *Kernel density estimation, nonparametric statistics, tropical rainfall, rainfall distribution, southern Peninsular Malaysia*

## SAP-WEB: A Secure and Compliant Apple Pay Web Integration Framework for Electricity Utility Billing Systems [Oral: A0114]

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## Background

The recent expansion of Apple Pay support to third-party web browsers has enabled broader adoption of browser-based digital payment services. However, integrating Apple Pay into electricity utility billing systems remains challenging due to browser interoperability, secure payment processing, merchant validation, and compliance with industry security standards. Existing studies mainly address payment security or digital wallet adoption independently, with limited guidance on developing an integrated implementation framework for utility billing environments. This study addresses this gap by proposing a structured and secure framework for browser-based Apple Pay integration.

## Objective

This study aims to develop and evaluate SAP-WEB, a secure and standards-compliant implementation framework for integrating Apple Pay into browser-based electricity utility billing systems while supporting browser interoperability, payment security, and regulatory compliance.

## Methods

The framework was developed using the Design Science Research (DSR) methodology. A prototype was implemented using Apple's sandbox environment and evaluated through functional testing and security assessment. The evaluation employed the OWASP Web Security Testing Guide checklist and the PCI DSS v4.0 self-assessment checklist to validate security controls, merchant validation, payment tokenization, domain validation, and payment authorization.

## Results

The proposed framework successfully integrated Apple Pay into browser-based electricity utility billing workflows. The prototype achieved successful merchant validation, payment tokenization, domain validation, and 100% payment authorization in Apple's sandbox environment. Security evaluation identified no critical OWASP Top 10 vulnerabilities, while all applicable PCI DSS controls were satisfied. The framework also demonstrated secure communication using TLS 1.3 and provided a structured architecture that simplifies implementation while maintaining regulatory compliance and supporting recurring utility billing operations.

## Conclusion

SAP-WEB provides a practical and reusable implementation framework for secure Apple Pay deployment across multiple web browsers in electricity utility billing systems. The framework integrates browser interoperability, security mechanisms, payment gateway integration, and compliance requirements into a unified architecture, offering practical guidance for utility providers seeking secure and standards-compliant digital payment solutions.

**Keywords:** *Apple Pay, electricity utility billing, browser-based payments, PCI DSS, secure web transactions*



## POSTER PRESENTATIONS

### SYMPOSIUM TRACK 1: BIOLOGY & CHEMISTRY

#### Plant-Based Meat Analogues Using Palm Oil Fractions: Texture Optimisation, Formulation Stability and Consumer Acceptability Across Sausage and Burger Patty Formats [Poster: A0015]

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#### Background

Plant-based meat analogues (PBMA) are rapidly growing due to increased demand for healthier, affordable and sustainable foods. However, many commercial PBMA rely on imported oils and high-cost processing technologies, limiting accessibility for local food manufacturers and SMEs. Palm oil fractions provide a locally available, oxidatively stable and cost-effective functional fat system that may improve the commercial feasibility of PBMA.

#### Objective

To develop an affordable plant-based meat analogue incorporating optimised palm oil fractions as the fat component and evaluate its consumer acceptability in relation to textural properties and product stability across multiple product formats.

#### Methods

A plant-based vegan sausage was evaluated against commercial controls using a 9-point hedonic scale (n = 60), followed by consumer-guided refinement and evaluation of vegan and hybrid burger patties. Instrumental texture profile analysis (TPA) and stability assessments over seven freeze-thaw cycles and six months of frozen storage were conducted.

#### Results

The palm oil-based formulation achieved texture comparable to commercial plant-based products, supported by instrumental TPA and consumer sensory evaluation. The initial sausage formulation demonstrated that overall acceptability was primarily limited by flavour intensity rather than structural performance, indicating that seasoning optimisation rather than formulation redesign was required. Following consumer-guided reformulation, burger patty variants showed improved consumer acceptance, with the 10% beef hybrid ranked first by 41.7% of panellists. The formulation maintained frozen stability, retaining high water-holding capacity (>99.4%) with minimal syneresis throughout seven freeze-thaw cycles and 24 weeks of frozen storage. A single formulation was successfully adapted into multiple PBMA formats including sausages, burger patties, meatballs, pepperoni and bak kua.

#### Conclusion

The plant-based analogue containing palm oil fractions demonstrated strong textural performance and formulation stability. Flavour authenticity remains the key development priority, which is being addressed through an ongoing hybrid burger sensory evaluation comparing a fully plant-based against a partial real-meat variant.

**Keywords:** *Palm oil fractions, plant-based meat analogue, consumer acceptability, texture profile analysis*

#### Stability of Red Palm Oil in Cheddar Cheese Analogue as Natural Colourant Upon Refrigerated Storage [Poster: A0069]

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#### Background

Carotenes occur naturally in milk-derived cheese and may also be incorporated into cheese analogues through fortification. Red palm oil, a rich source of carotene, is typically used in minimally heated applications due to the susceptibility of carotenoids to degradation. Its incorporation into Cheddar cheese analogue offers a potential source of these bioactive compounds while also serving as a natural colourant. Despite growing industry interest in value-added palm-based foods, the application of red palm oil in cheese products remains largely unexplored, and its stability within a cheese matrix has yet to be established.

#### Objective

To evaluate the stability of beta-carotene and colour in Cheddar cheese analogue upon storage.

#### Methods

Cheddar cheese analogue containing red palm oil (CDRPO) was evaluated against sample containing palm olein (CDPOo) as the control upon storage for 24 weeks at refrigerated temperature (5°C). The cheese samples were analysed for colour ( $L^*$ ,  $a^*$  and  $b^*$ ). Beta-carotene content was analysed using UV-Vis spectrophotometer at 446 nm.

#### Results

The colour parameters of CDRPO, including lightness ( $L^*$ ), redness ( $a^*$ ) and yellowness ( $b^*$ ), remained stable throughout storage. In contrast, CDPOo showed an increase in  $L^*$  and  $a^*$  values. Maintaining colour stability during storage is important for Cheddar cheese analogue, as colour influences consumers' perception of product quality and batch consistency on the shelf. Beta-carotene content slightly decreased in both samples during storage. However, CDRPO showed higher retention at approximately 97%, compared with 78% in CDPOo.

#### Conclusion

The stability of colour and  $\beta$ -carotene content in CDRPO demonstrates the potential of red palm oil as a natural colourant in Cheddar cheese analogue. Its incorporation not only imparts colour but also enhances the nutritional value of the product.

**Keywords:** *Cheddar cheese analogue, red palm oil, beta-carotene*

## Assessing the Safety of Niosome Encapsulating *Eurycoma longifolia* on Zebrafish Embryonic Larvae Development [Poster: A0084]

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### Background

*Eurycoma longifolia* is a traditional medicinal plant with various therapeutic benefits, including immunomodulatory activity, but its potential is limited by the poor bioavailability of eurycomanone. Therefore, niosome formulations were developed to encapsulate the extract. However, information on the safety of niosome encapsulating *E. longifolia* towards zebrafish embryonic development remains limited.

### Objective

This present study aims to evaluate the toxicity of these niosome formulations using zebrafish (*Danio rerio*) embryo larvae test.

### Methods

Three *E. longifolia*-loaded niosome formulations containing different stabilising agents: sodium dodecyl sulphate (Nio1),  $\alpha$ -tocopherol (Nio2), and phenonip (Nio3) were prepared using the heating method. Acute toxicity was evaluated according to Organisation for Economic Co-operation and Development (OECD) Test Guideline (TG) 236 (Fish Embryo Acute Toxicity Test) using zebrafish embryos exposed to concentrations ranging from 1.57 to 200  $\mu$ g/mL for 72 h post-exposure (hpe). Untreated embryos served as the negative control.

### Results

All niosome formulations exhibited concentration and time dependent toxicity toward zebrafish embryos. Acute toxicity analysis showed that Nio2 exhibited the highest LC<sub>50</sub> (80.46  $\mu$ g/mL) indicating lowest toxicity among the tested formulations and *E. longifolia* extract. Nio2 also caused least disruption to embryonic development and maintained higher embryo survival, demonstrating that the choice of stabilising agent significantly influences the safety profile of the niosomes.

### Conclusion

Overall, Nio2 demonstrated the promising safety profile and represents a potential niosome carrier for *E. longifolia* extract. These findings contribute to the development of innovative nanomedicine strategies for improving the safety of herbal therapeutics.

**Keywords:** *Eurycoma longifolia*, niosome, zebrafish, toxicity, embryo

## Phytochemical Analysis and Larvicidal Efficacy of Vitex trifolia Extracts against Laboratory Strain *Aedes aegypti* Larvae [Poster: A0111]

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### Background

Dengue fever and dengue haemorrhagic fever continue to pose significant public health challenges in Malaysia, with prevalence data indicating a rising trend. Resistance to synthetic insecticides among mosquito populations has reduced the effectiveness of conventional control measures, necessitating the exploration of natural, eco-friendly, and safe alternatives.

### Objective

This study investigated the phytochemical composition and larvicidal efficacy of different parts of *Vitex trifolia* against *Aedes aegypti*, the primary vector of dengue.

### Methods

Stem, leaves, fruit, and flower buds of *V. trifolia* were extracted using hydrodistillation and maceration techniques. Phytochemical constituents were analysed via gas chromatography. Larvicidal activity was assessed against third-instar *Aedes aegypti* larvae using a standard bioassay method.

### Results

The methanol and chloroform extracts of flower buds demonstrated the strongest larvicidal activity, achieving 100% mortality at the lowest tested concentration of 17.5 ppm. Other plant parts exhibited comparatively lower activity, suggesting that bioactive compounds are concentrated in the flower buds.

### Conclusion

The findings highlight the potential of *V. trifolia* fruit and flower bud extracts as effective natural larvicides against *Aedes aegypti*. Their strong activity at low concentrations underscores their promise as eco-friendly alternatives to synthetic insecticides. Incorporating such plant-based agents into vector control programs could enhance sustainability, reduce environmental impact, and mitigate resistance issues.

**Keywords:** Dengue fever, *Vitex trifolia*, phytochemicals, larvicidal activity, *Aedes aegypti*, natural insecticide, eco-friendly vector control.

## Coupling Field-Scale Rusle Monitoring and Laboratory Rainfall Simulations for Tropical Slope Bioengineering [Poster: A0117]

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### Background

Slope failures and soil erosion are significant geohazards in tropical environments, highlighting the need for sustainable bioengineering strategies for long-term slope stabilization.

### Objective

This study assessed the temporal impact of vegetation canopy development on slope erosion using an integrated framework that combined field-scale Revised Universal Soil Loss Equation (RUSLE) monitoring with controlled laboratory rainfall simulations.

### Methods

The RUSLE framework was temporally parameterized by updating the cover-management (C) factor to reflect canopy development throughout the monitoring period. We evaluated two tropical shrub species, *Strobilanthes crispus* (SC) and *Pseuderanthemum carruthersii* (PC), on 40° field plots. Complementary rainfall simulations were performed on a 15° laboratory flume at an applied intensity of 32.54 mm/hr. This intensity is classified as high by the Department of Irrigation and Drainage Malaysia and is consistent with extreme tropical storm erosivity (R factor = 2395.54 Mg mm ha<sup>-1</sup> h<sup>-1</sup>), as evaluated in the field RUSLE model.

### Results

Field observations revealed that both species significantly reduced estimated soil loss compared to the bare control (4232.77 t ha<sup>-1</sup> yr<sup>-1</sup>). SC established more rapidly, achieving approximately 70% canopy cover by Month 3 and reducing estimated soil loss to 2.50 t ha<sup>-1</sup> yr<sup>-1</sup> by Month 6. In contrast, PC reduced soil loss to 5.09 t ha<sup>-1</sup> yr<sup>-1</sup>. However, under simulated high-intensity rainfall, PC produced significantly lower sediment yield than SC at 80% canopy cover. This suggests that differences in canopy architecture may mitigate localized canopy-drip erosivity.

### Conclusion

Overall, these results demonstrate that temporally updating the RUSLE C-factor offers a more realistic representation of vegetation development than conventional static parameterization, supporting the use of shrub-based bioengineering for tropical slope protection.

**Keywords:** Canopy interception, dynamic RUSLE, rainfall simulation, slope bioengineering, tropical slopes

## Biochemical Characterization of Transglutaminase from the Mangrove-Derived *Bacillus* sp. CCB-MMP212 [Poster: A0120]

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### Background

Transglutaminase (TG; EC 2.3.2.13) catalyzes acyl-transfer reactions that generate covalent crosslinks between glutamine and lysine residues in proteins. This crosslinking activity enables protein modification and has led to the widespread use of TG in the food, chemical, medical, and cosmetic industries. Among bacterial transglutaminases, Tgl is currently the smallest known enzyme and is produced as a single-domain protein in its active form by *Bacillus subtilis*. Tgl-like proteins are restricted to spore-forming bacteria within the *Bacillus* and *Clostridia* species, suggesting an ancient evolutionary origin. Despite increasing interest in these enzymes, limited information is available regarding their catalytic mechanism and structural basis of activity. Therefore, biochemical characterization of *Bacillus*-derived transglutaminases is essential to improve our understanding of their catalytic properties and to support future protein engineering for industrial applications.

### Objective

This study aimed to clone, express, purify, and biochemically characterize the transglutaminase encoded by the tgl gene from *Bacillus* sp. CCB-MMP212. In addition, sequence alignment and structural modelling were performed to identify putative catalytic residues and provide a basis for future mutagenesis and protein engineering.

### Methods

The tgl gene from *Bacillus* sp. CCB-MMP212 was cloned and heterologously expressed in *Escherichia coli* BL21 (DE3). The recombinant enzyme was purified and biochemically characterized to determine its temperature and pH stability and optimal activity. Protein crosslinking activity was evaluated using skim milk and bovine serum albumin (BSA) as model substrates, and the reaction products were analysed by SDS-PAGE. Sequence alignment and structural modelling were performed to identify putative catalytic residues and examine their structural conservation.

### Results

The tgl gene was successfully cloned, and the recombinant transglutaminase was successfully expressed and purified. The enzyme exhibited broad stability over a temperature range of 30–60°C and a pH range of 6–9, with optimal activity at 50°C and pH 8. Crosslinking assays confirmed the enzyme's ability to crosslink both skim milk and bovine serum albumin (BSA), while SDS-PAGE analysis revealed the formation of high-molecular-weight protein polymers within 30 minutes of incubation, confirming effective protein crosslinking. Furthermore, sequence alignment and structural modelling identified conserved residues E116, H117, and E189 as putative catalytic residues, supporting their proposed role in catalysis and providing a structural basis for future mutagenesis studies.



## Conclusion

This study presents the first biochemical characterization of a transglutaminase from the mangrove-derived *Bacillus* sp. CCB-MMP212. The enzyme exhibited broad operational stability and efficient protein crosslinking activity, highlighting its potential for industrial applications. In addition, the identification of putative catalytic residues provides insights into its catalytic mechanism and establishes a foundation for future mutagenesis, structural studies, and protein engineering.

**Keywords:** *Transglutaminase, Bacillus* sp. CCB-MMP212, biochemical characterization, protein crosslinking, structural modelling.

## Phylogeography of *Nilaparvata lugens* and *Micraspis discolor* Across Four Zones in Peninsular Malaysia [Poster: A0123]

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## Background

Understanding the genetic structure and evolutionary history of agricultural insect pests and their natural predators is essential for developing sustainable pest management strategies. However, information on the phylogeographic patterns of the brown planthopper (*Nilaparvata lugens*) and its predatory beetle (*Micraspis discolor*) in Peninsular Malaysia remains limited.

## Objective

This study aimed to investigate the phylogeography and genetic diversity of *N. lugens* and *M. discolor* across four geographical zones in Peninsular Malaysia and to evaluate how species-specific mobility influences regional population dynamics.

## Methods

Samples of *N. lugens* and *M. discolor* were collected from multiple locations representing four geographical zones in Peninsular Malaysia. The mitochondrial cytochrome c oxidase subunit I (COI) gene was amplified and sequenced, and Neighbor-Joining (NJ) phylogenetic trees were constructed together with regional reference sequences to assess genetic relationships and population structure.

## Results

The NJ phylogenetic analysis revealed contrasting genetic patterns between the two species. *N. lugens* exhibited a highly homogeneous genetic structure, with individuals from all sampling locations clustering into a single lineage closely related to the reference sequence. In contrast, *M. discolor* displayed multiple distinct evolutionary lineages, indicating greater genetic diversity. Nevertheless, these lineages were not associated with geographical locations, as individuals from all four zones were intermixed within the phylogenetic tree. The absence of geographical clustering in both species suggests low population differentiation and moderate-to-high gene flow, indicating that the dispersal capabilities of both the pest and its predator effectively reduce geographical isolation across Peninsular Malaysia.

## Conclusion

This study demonstrates contrasting genetic diversity between *N. lugens* and *M. discolor* while highlighting the important role of species-specific mobility in shaping population structure. The findings provide valuable baseline information for understanding the population dynamics of rice agroecosystems in Malaysia and support the development of effective pest management and biological control strategies.

**Keywords:** *Phylogeography, Nilaparvata lugens, Micraspis discolor, COI, Neighbor-Joining.*

## Structure–Activity Relationship of Food-Derived Anti-Diabetic Peptides Targeting $\alpha$ -Amylase, $\alpha$ -Glucosidase and Dipeptidyl Peptidase-IV: Insights for Rational Peptide Design [Poster: A0126]

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## Background

Type 2 diabetes mellitus (T2DM) remains a global health challenge, with food-derived bioactive peptides offering a biocompatible therapeutic alternative to synthetic drugs. Inhibition of  $\alpha$ -amylase and  $\alpha$ -glucosidase delays intestinal glucose release, whereas inhibition of dipeptidyl peptidase-IV (DPP-IV) prolongs incretin activity, enhancing insulin secretion and glycaemic control.

## Objective

This study comparatively investigated the structure–activity relationships (SAR) of peptides targeting  $\alpha$ -amylase (AA),  $\alpha$ -glucosidase (AG), and DPP-IV to identify common molecular features that govern inhibitory activity and guide peptide design.

## Methods

In silico analysis categorized peptides from the BioPEP-UWM database as short (2–5), medium (6–10), or long (>10) residues. Pepsite2 predicted peptide binding sites, while HADDOCK2.4 and LigPlot were employed for docking-based interaction analysis at ultimate, penultimate, and antepenultimate positions.

## Results

DPP-IV inhibitory peptides showed N1-Leu/Pro, N2-Leu/Ala, and N3-Pro as key N-terminal residues, while C-terminal positions featured C1-Arg/Phe, C2-Pro, and C3-Pro/Ile, interacting with the Ser630-containing catalytic region and Tyr629/Tyr666 hotspots. AG inhibitory peptides displayed N1-Lys and C1-Arg/Lys as dominant terminal residues, with supporting contributions from N2-Gln, N3-Pro/Ala, C2-Arg/Pro, and C3-Lys/Gln, supporting electrostatic interactions with Asp518/Asp616. AA inhibitory peptides utilized N1-Pro/Arg, N2-Val/Leu, and N3-Pro/Ala to interact with key hotspots Trp58/Trp59. C-terminal residues (C1-Arg/Ala, C2-Pro/Arg, C3-Arg/Gln) contributed to steric and electrostatic interactions that may hinder substrate access. Across all enzymes, hydrophobic residues were the primary drivers of terminal binding.

## Conclusion

Terminal amino acid preferences vary with peptide length but consistently highlight hydrophobic and aliphatic residues as key contributors to binding. These findings provide a structural framework for the rational design of multifunctional anti-diabetic peptides with potential multi-target activity across metabolic pathways.

**Keywords:** *Anti-diabetic peptides, structure–activity relationship;  $\alpha$ -Amylase;  $\alpha$ -Glucosidase; DPP-IV; molecular docking; bioactive peptides; functional foods*

## The Boba Tea Hazard: Revealing the Synergistic Health Risks of Sugar Loads and Endocrine-Disrupting Chemicals [Poster: A0141]

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## Background

Current safety models evaluate Boba Milk Tea risks independently. By integrating chemical analysis with toxicological literature, this study introduces a synergistic framework detailing the collective impact of extreme sugar loads and packaging-derived endocrine-disrupting chemicals (EDC) in accelerating human metabolic dysfunction.

## Objective

To quantify nutritional loads of free sugars and total calorie, and assess thermal-induced EDC migration in five commercial brands.

## Methods

Five commercial BMT brands (Brand A-E) were partitioned into liquid and solid phases. Free sugars, total calorie, and chemical migration were analytically quantified using HPLC-RID, bomb calorimetry, and GC-MS respectively.

## Results

Total sugar concentrations ranged from 43.15 g to 57.99 g (Brand E) per 450 mL serving, with total calories reaching up to 317 kcal. Notably, all tested brands violated Ministry of Health guidelines, while Brands A, B, and E additionally exceeded the global WHO limit of 50 g/day. Tapioca pearls functioned as hidden reservoirs due to hyper-concentrated syrup steeping, sequestering up to 11.5% of the total sugar mass. Standard Hot-Fill protocols of dispensing 48°C pearls into polypropylene containers exceeded polymer relaxation constraints, fracturing weak intermolecular van der Waals forces. This facilitated rapid diffusion of free BPA into the solution. Cumulative migration reached a staggering 58.31 µg per serving in Brand E. Free BPA levels ranging from 36.05 to 58.22 µg exceeded European Food Safety Authority limits by 1,000-fold. This extreme co-ingestion triggers a dual-action metabolic blockade where BPA blocks the body's insulin pathways and prevents cells from absorbing sugar, while excess fructose drives aggressive fat production in the liver.

## Conclusion

The combination of hyper-leached BPA under thermal preparation and extreme sugar density creates a severe synergistic metabolic hazard of Type 2 Diabetes and Non-Alcoholic Fatty Liver Disease. Immediate industrial interventions are necessary, specifically mandatory pre-cooling protocols below 25°C and transitioning to inert bio-plastic packaging.

**Keywords:** *Boba milk tea, food safety, endocrine-disrupting chemicals, migration, sugar-sweetened beverages.*

## Impact of Extracellular Matrix Proteins (ECM) on Tight Junction Integrity in hCMEC/D3 Blood–Brain Barrier (BBB) Models [Poster: A0183]

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## Background

The development of reliable *in vitro* blood-brain barrier (BBB) models remains a major challenge in central nervous system (CNS) drug discovery, as inaccurate models can lead to poor prediction of drug permeability. Human cerebral microvascular endothelial cells (hCMEC/D3) are widely used in BBB studies but often exhibit low transendothelial electrical resistance (TEER), reflecting limited barrier integrity and tight junction formation. Although extracellular matrix (ECM) coatings and neuronal co-culture have been explored to enhance BBB characteristics, conflicting findings have hindered the establishment of an optimized hCMEC/D3 model. Therefore, this study compared different ECM coatings and culture configurations to determine their effects on BBB integrity.

## Objective

This study evaluated the effects of ECM coating on barrier integrity in hCMEC/D3 monoculture and co-culture BBB models using TEER as an indicator of tight junction formation.

## Methods

hCMEC/D3 cells were cultured either as a monoculture or co-cultured with SH-SY5Y neuroblastoma cells on Transwell® inserts coated with collagen type I alone or collagen/fibronectin. Following monolayer formation, cyclic AMP-elevating agents were added daily to promote tight junction development. Barrier integrity was assessed by daily TEER measurements over a 10-day culture period.

## Results

TEER increased progressively in both monoculture and co-culture BBB models, reaching maximum values between days 4 and 6. Collagen/fibronectin-coated inserts produced higher TEER values than collagen-coated inserts in both BBB models. Co-culture BBB model with SH-SY5Y cells did not significantly improve barrier integrity compared with monoculture model, indicating that ECM composition had a greater influence on BBB integrity under the present experimental conditions.

## Conclusion

Collagen/fibronectin coating enhanced barrier integrity in both BBB models, with the monoculture model producing the highest TEER values. These findings support the use of collagen/fibronectin-coated hCMEC/D3 monoculture as a simple and reliable in vitro BBB model for future permeability and CNS drug transport studies.

**Keywords:** *Blood-brain barrier (BBB), extracellular matrix (ECM), human cerebral microvascular endothelial cells (hCMEC/D3), transendothelial electrical resistance (TEER), tight junction*

## Virgin Coconut Oil in Hepatocellular Carcinoma: Bioactive Compounds and Therapeutic Potential [Poster: A0201]

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## Background

Hepatocellular carcinoma (HCC) is the most common primary liver malignancy and remains a leading cause of cancer-related mortality worldwide. Despite advances in surgery, targeted therapy, and immunotherapy, treatment outcomes are frequently limited by tumour recurrence, drug resistance, and treatment-associated toxicity. These challenges have increased interest in natural products as complementary therapeutic approaches. Virgin coconut oil (VCO) contains diverse bioactive constituents, including medium-chain triglycerides, lauric acid, polyphenols, tocopherols, and phytosterols, which have been reported to possess antioxidant, anti-inflammatory, and antiproliferative properties.

## Objective

This mini review summarizes the major bioactive compounds of VCO and critically evaluates current preclinical evidence regarding its potential therapeutic role in hepatocellular carcinoma.

## Methods

A narrative literature search was conducted using peer-reviewed articles published between 2010 and 2026 from PubMed and Google Scholar. Studies investigating the chemical composition, biological activities, antiproliferative effects, hepatoprotective properties, and therapeutic applications of VCO in HCC and related experimental models were reviewed and synthesized.

## Results

Available evidence is currently limited to in vitro and preclinical studies. Collectively, these studies indicate that VCO and its bioactive constituents exert antiproliferative effects by reducing oxidative stress, modulating inflammatory pathways, inducing apoptosis, and suppressing cancer cell proliferation. Several experimental studies also reported hepatoprotective effects, including attenuation of chemotherapy-induced liver injury and improvement of endogenous antioxidant defence. In addition, recent investigations into lipid-based nanoformulations suggest that VCO may serve as a biocompatible carrier for targeted drug delivery, although this application remains at an early stage of development.

## Conclusion

Current preclinical evidence suggests that VCO possesses bioactive compounds with biological activities relevant to HCC management, including antioxidant, anti-inflammatory, hepatoprotective, and antiproliferative effects. However, these findings should be interpreted cautiously, as clinical evidence in patients with HCC is currently lacking. Further mechanistic studies, standardized VCO formulations, and well-designed clinical trials are needed to determine its safety, efficacy, and potential role as a complementary therapeutic strategy in HCC.

**Keywords:** *Virgin coconut oil, hepatocellular carcinoma, bioactive compounds, antiproliferative activity, oxidative stress*

## Drifters vs. Clingers: How Salinity and Substrate Shape Seaweed Life Forms in a Tropical Estuary [Poster: A0216]

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## Background

Macroalgae are vital ecosystem engineers in tropical coastal environments, yet their structural complexity and distribution are heavily dictated by physical environmental constraints.

## Objective

This study investigates how spatial gradients—specifically salinity and substrate stability—shape seaweed life forms in the Kong Kong Wetland, Johor, Malaysia.

## Methods

Field surveys across seven estuarine-coastal sites identified 20 macroalgal species, which were categorized by their attachment strategies into drift (unattached), epipellic (mud/sand-attached), epilithic (rock-attached), and epizoic (animal-attached) life forms. Nonparametric correlations and Principal Component Analysis (PCA) were utilized to evaluate community shifts.

## Results

The findings reveal a distinct functional shift along the estuarine-to-coastal continuum. The turbid, soft-sediment northern estuarine zones are functionally skewed toward opportunistic "drifters" (free-floating taxa like *Ulva* spp.), which adapt easily to unstable fine sediments. Conversely, the more marine-influenced southern sites feature firmer sandy-muddy and rocky substrates that support highly diverse and structurally complex "clingers" (epilithic and epipellic forms, such as *Gracilaria* and *Padina*). Nonparametric correlations and PCA confirmed that this functional progression and macroalgal species richness are significantly driven by the spatial north-to-south gradient ( $p = 0.847$ ) and stable salinity ( $p = 0.775$ ), rather than transient water quality fluctuations.



## Conclusion

The transition from drift-dominated assemblages to attached, complex macroalgal communities highlights how substrate stability and salinity actively regulate benthic ecosystems. Monitoring these life-form traits serves as a valuable bioindicator for assessing habitat stability and environmental impacts in rapidly developing tropical estuaries.

**Keywords:** *Seagrass, macroalgae, habitat characterization, biodiversity, conservation, Kong Kong Wetland*

## SYMPOSIUM TRACK 2: PHYSICS & ENGINEERING

### Synthesis and Characterization of ZnO quantum dots and Cu<sub>2</sub>O nanowires Photocatalyst for Water-splitting Hydrogen Energy Production [Poster: A0147]

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## Background

The development of efficient and sustainable photocatalysts for producing hydrogen through water splitting is a critical step in advancing clean energy technologies.

## Objective

The study aims to synthesize a visible light-driven ZnO/Cu<sub>2</sub>O heterojunction photocatalyst and evaluate its photocatalytic performance in generating hydrogen.

## Methods

The ZnO quantum dots (QDs) were prepared via a chemical process using zinc acetate dihydrate and lithium hydroxide monohydrate precursors, with ligands like triethanolamine (TEA) added as a stabilizer. Cu<sub>2</sub>O nanowires were prepared by anodizing polished copper foil to grow Cu(OH)<sub>2</sub> nanowires, calcining them to form CuO, and then annealing them in an argon atmosphere to achieve Cu<sub>2</sub>O. The structural, morphological, and optical properties of the materials were analyzed using techniques such as HRTEM, XRD, UV-Vis spectroscopy, and FESEM to confirm heterojunction formation. The photocatalytic performance was then evaluated under simulated solar irradiation using a two-electrode system in electrolyte solutions (like Na<sub>2</sub>SO<sub>4</sub> and KOH).

## Results

Characterizations confirmed the successful formation of the heterojunction with favorable interfacial contact, which helps enhance charge separation and extend light absorption into the visible region. Testing revealed that the size of the synthesized ZnO nanoparticles varied slightly depending on the ligand used, and the TEA ligand showed the smallest size ~2.76 nm. Under simulated solar irradiation, the ZnO/Cu<sub>2</sub>O photocatalyst demonstrated a synergistic effect and photoelectrochemical responses compared to pure Cu-Strip.

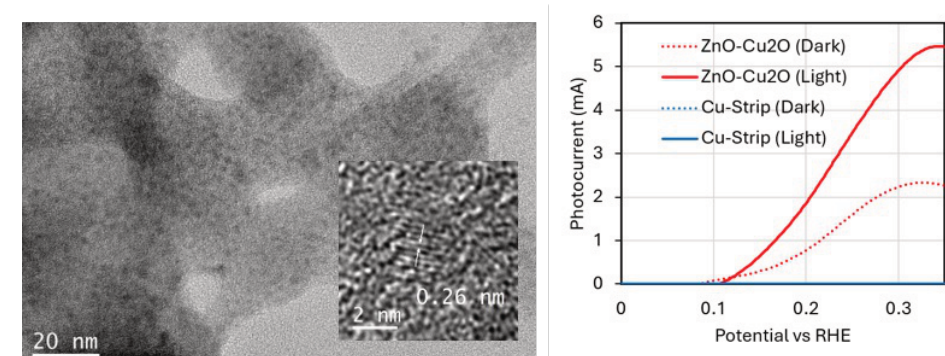


Fig. 1. TEM image of ZnO QDs and PEC plot of the ZnO/Cu<sub>2</sub>O.

## Conclusion

The findings highlight the significant potential of ZnO/Cu<sub>2</sub>O heterostructures as cost-effective and environmentally friendly materials for solar-driven hydrogen production. This research advances the development of high-performance photocatalysts that can operate efficiently under visible light, moving a step closer to practical, renewable hydrogen energy systems

**Keywords:** ZnO/Cu<sub>2</sub>O heterojunction, visible light photocatalysis, water splitting, hydrogen production

## Effect of Pt/Sn Atomic Ratio on the Structural and Electrocatalytic Performance of Unsupported PtSn Nanoparticles for Methanol Oxidation in Alkaline Media [Poster: A0156]

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## Introduction

Direct methanol fuel cells (DMFCs) are promising clean energy devices; however, the practical application of Pt electrocatalysts is hindered by carbon monoxide (CO) poisoning and high material cost. Alloying Pt with Sn enhances catalytic activity through the bifunctional mechanism and electronic effects, improving CO tolerance and methanol oxidation kinetics. This study investigates the influence of Pt/Sn atomic ratio on the structural, morphological, and electrocatalytic properties of unsupported PtSn nanoparticles.

## Objective

To determine the optimum Pt/Sn atomic ratio that provides enhanced alloy formation, improved morphology and superior electrocatalytic performance for methanol oxidation in alkaline media.

## Methods

Unsupported PtSn nanoparticles with Pt:Sn atomic ratios of 3:1, 2:1, 1:1, 1:2, and 1:3 were synthesized via chemical reduction using H<sub>2</sub>PtCl<sub>6</sub>·6H<sub>2</sub>O and SnCl<sub>2</sub> with NaBH<sub>4</sub> as the reducing agent, polyvinylpyrrolidone (PVP) as the stabilizer, and tetraethylene glycol (TEG) as the reaction medium. The catalysts were annealed at 600°C for 3 h under a nitrogen atmosphere. Structural and morphological characterization was performed using X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy (EDX) and particle size distribution analysis. Electrocatalytic performance toward the methanol oxidation reaction (MOR) was evaluated using cyclic voltammetry (CV) and chronoamperometry (CA) in alkaline media.

## Results

XRD confirmed Pt-based crystalline phases, while the PtSn (1:1) catalyst exhibited the most distinct PtSn alloy peak, indicating effective alloy formation. FESEM and particle size analysis revealed that PtSn (1:1) possessed the most homogeneous nanoparticle distribution with minimal agglomeration and a narrow particle size distribution. EDX verified the presence of Pt and Sn in all catalysts, with surface composition varying according to the Pt/Sn ratio. Electrochemical measurements showed that Pt-rich catalysts exhibited higher current responses in blank alkaline electrolyte due to the greater availability of Pt active sites. In contrast, PtSn (1:1) demonstrated the highest methanol oxidation activity and excellent catalytic stability, attributed to the synergistic interaction between Pt and Sn, where Pt

promotes methanol adsorption while Sn facilitates the oxidation of CO intermediates through the bifunctional mechanism.

## Conclusion

Overall, the Pt/Sn atomic ratio significantly influences alloy formation, morphology, particle size and electrocatalytic behaviour. The PtSn (1:1) catalyst exhibited the best balance between structural characteristics, catalytic activity, and CO tolerance, demonstrating its potential as an efficient unsupported electrocatalyst for alkaline direct methanol fuel cell applications.

**Keywords:** Bimetallic alloy, PtSn; electrocatalyst, DMFCs, alkaline media

## SYMPOSIUM TRACK 3: RESEARCH MANAGEMENT & SOCIAL SCIENCES

### Bridging the Academic-Industry Divide: The Impact of Centralized Research Branding (UTM Nexus) on Innovation Visibility and Partnership [Poster: A0042]

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#### Background

In the contemporary higher education landscape, research-intensive universities frequently encounter the "Valley of Death"—a critical gap where high-potential scientific discoveries fail to achieve commercialization or societal impact due to poor visibility and misaligned communication. While institutional research outputs remain high, the hyper-specialized nature of fields such as bioprocess engineering and molecular biology often creates a disconnect between academic researchers and external stakeholders, including industry investors, policymakers, and the public.

#### Objective

This paper examines the strategic development and implementation of "UTM Nexus" at Universiti Teknologi Malaysia (UTM) as a centralized research branding and science communication initiative designed to democratize complex university research and foster multidisciplinary partnerships.

#### Methods

Operating from the Office of the Deputy Vice-Chancellor (Research and Innovation), the UTM Nexus framework was developed by integrating principles of scientific translation, digital branding, and research management administration (RMA). To systematically evaluate the impact of this initiative and replace prior reliance on informal observation, a mixed-methods evaluation approach was employed utilizing multi-platform data sources. First, digital innovation visibility and stakeholder engagement were quantified using Google Analytics (GA) and YouTube Studio analytics to track user acquisition, global reach, and content retention over the deployment period (2020–2026). Second, institutional outcome data was extracted from the UTM Scholar database to assess the correlation between enhanced digital visibility and tangible research collaborations, specifically tracking Principal Investigator (PI) participation and grant acquisition metrics.

#### Results

The systematic evaluation of UTM Nexus demonstrates clear, measurable improvements in both digital visibility and institutional partnership development. In terms of innovation visibility and global reach, Google Analytics recorded over 1.2 million cumulative page views and 471,381 total users, with a strong international footprint spanning Malaysia, China, Singapore, and Indonesia. Targeted research hub pages (e.g., NEXPO, AMTEC) consistently drove the highest traffic. Stakeholder engagement and digital content retention were robust, evidenced by an average user engagement time of 1 minute and 18 seconds. Digital publication releases (e.g., the 12th and 13th issues) achieved approximately 1,000 targeted views each. Furthermore, the establishment of the UTM Nexus Studio produced 95 science communication videos. Strategic multimedia placements, such as the BookCast and Unveiling Research podcast series, generated sustained engagement, with top episodes exceeding 800 views. Finally, regarding institutional and collaborative outcomes, this enhanced visibility directly supported institutional outreach. By actively translating academic IP for non-academic audiences, the platform

facilitated visibility for the university's robust research portfolio, which successfully supported 756 Principal Investigators (PIs), maintaining 1,623 active grants and securing 117 newly registered grants in 2026. Structural outcomes also included the mandated adoption of the UTM Nexus Care logo across corporate social responsibility (CSR) programs, unifying the institutional brand.

#### Conclusion

Strategic research branding transcends traditional marketing; it functions as a vital operational tool within modern Research Management. By implementing frameworks like UTM Nexus, universities can actively mitigate the academic-industry divide. The comprehensive data underscores that structured science communication significantly boosts global innovation visibility, which in turn acts as a catalyst for external inquiries and collaborative opportunities. This proven engagement model successfully transforms passive external audiences into active industry collaborators, ensuring that empirical research translates into tangible socioeconomic value while cultivating a culture of translational research among principal investigators.

**Keywords:** *Research branding, science communications, university-industry collaboration, research management, translational research, impact evaluation*

### Trend Analysis of Bullying among Malaysian in-school Adolescents (2012- 2022) [Poster: A0072]

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#### Background

Bullying is one of the most common forms of school violence and is associated with adverse physical, psychological, and social outcomes among adolescents.

#### Objective

This study aims to determine trends in bullying prevalence among Malaysian in-school adolescents from 2012 to 2022 and to examine factors associated with bullying across survey years.

#### Methods

Secondary data from the National Health and Morbidity Survey (NHMS) 2012, 2017, and 2022 were analysed. All surveys employed validated self-administered bilingual (Malay and English) questionnaires to assess health behaviours, mental health status, and risk-related behaviours among adolescents. Complex sample analysis was conducted to estimate bullying prevalence and logistic regression was used to identify associated factors using SPSS version 31.

#### Results

The prevalence of bullying among in-school adolescents declined from 16.0% in 2012 to 8.4% in 2022. Across all survey years, bullying was strongly associated with involvement in physical fights and physical attacks, with adjusted odds ratios ranging from 1.66 (95% CI: 1.48, 1.87) to 3.1 (95% CI: 2.74, 3.51). Bullying was also consistently associated with suicide attempts with aOR ranged from 1.52 (95% CI: 1.40, 1.66) to 1.30 (95% CI: 1.15, 1.47) and depression with aOR ranged from 1.52 (95% CI: 1.40, 1.66) to 2.02 (95% CI: 1.83, 2.25). Adolescents with loneliness, sleep problems, and lack of close friends also have the same odds with the adjusted odds ratios ranged between 1.38 to 1.66.



## Conclusion

Although bullying prevalence decreased substantially over the study period, it remained strongly associated with violence exposure and adverse mental health outcomes highlighting a critical need for targeted action. It is essential to strengthen school-based anti-bullying programs and integrate robust psychosocial support interventions accounting for the associated factors identified including loneliness, sleep problems, and social isolation.

**Keywords:** *Bullying, adolescents, school, longitudinal*

## Lived Experiences of Young Adults Using AI Chatbots for Mental Health Support: A Phenomenological Approach [Poster: A0078]

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## Background

Artificial Intelligence (AI) is increasingly being used as a mental health support tool, particularly among young adults. While previous literature has primarily examined the application of AI chatbots in clinical and technological contexts, limited research has explored the lived experiences and perceptions of young adults who use AI chatbots for mental health support.

## Objective

Guided by Social Support Theory, this study aimed to explore how AI chatbots provide emotional, informational, and instrumental support to young adults, as well as to understand users' perceptions of their benefits and limitations.

## Methods

A qualitative phenomenological approach was adopted. Using purposive sampling, semi-structured interviews were conducted with three young adults aged between 18 and 30 years who had prior experience using AI chatbots as a mental health support tool. Interview data were analysed using thematic analysis, with recurring patterns and themes identified across participants. Data saturation was achieved as no new themes emerged from the final interview. While the sample size limits generalisability, it enabled an in-depth exploration of participants' lived experience.

## Results

Key themes emerged from the interviews: factors contributing to use of AI chatbots, perceived support, perceived effectiveness, and the perceived benefits as well as limitations of AI chatbots. Participants described AI chatbots as accessible sources of emotional support, reassurance, and guidance due to their availability, anonymity, and ease of use. However, participants also identified limitations, including the potential development of over-dependency and unhealthy emotional attachment towards AI chatbots.

## Conclusion

This study provides insight into the lived experiences of young adults using AI chatbots for mental health support. AI chatbots were perceived as valuable sources of accessible emotional and informational support; however, their temporary effectiveness and potential risks related to dependency and emotional attachment highlight the need for ethical AI development and careful integration alongside professional mental health services.

**Keywords:** *AI chatbots, mental health support, young adults, lived experiences*

## Exploring the Emotional Dependency Formed on Fictional Characters among Young Adults [Poster: A0081]

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## Background

Parasocial relationship has been a popular topic of research in both psychology and media studies sphere, examining the intricate relationship between fans and how they perceive their interactions with their favourite celebrities. The formation of a parasocial relationship stems from the emotional dependency formed between the viewer and a particular fictional character, which is prevalent among young adults. The current existing body of literature that investigates parasocial interactions and parasocial relationships through quantitative data collection and archival studies to develop themes.

## Objective

Horton and Wohl's Parasocial Interaction Theory guided this study's aim to understand the underlying reasons why this phenomenon occurs. The research primarily aims to explore factors, extent as well as perceived benefits and challenges that young adults experience from forming an emotional dependency with a fictional character.

## Methods

This study employed a qualitative phenomenological approach to explore the lived experiences of young adults who developed emotional dependency on fictional characters. Semi-structured interviews were conducted with three young adult participants to gain in-depth insights into their personal experiences and the factors contributing to such dependency. The interview data were analysed using thematic analysis.

## Results

Researchers have identified nine major themes: emotional dependence, parasocial attachment, media influences, character-specific factors, self-identity formation, social and community influence, interpersonal comparison, perceived benefits, and associated challenges. The findings revealed that fictional characters may serve as sources of comfort, identity exploration, emotional regulation, and social connection for young adults.

## Conclusion

This study contributes to a deeper understanding of the psychological and social functions of fictional characters in the lives of young adults and highlights the growing impact of media relationships in contemporary society.

**Keywords:** *Parasocial relationship, emotional dependency, fictional characters, young adults, phenomenology*

## Understanding the Perceived Functions and Effects of Slang in Undergraduate Students' Communication [Poster: A0090]

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### Background

Slang, a sociolinguistic phenomenon, is commonly associated with youth culture and is increasingly influenced by emerging technologies. With the ubiquity of Internet access, young adults are constantly exposed to digital culture, which serves as a breeding ground for acquiring, developing, and sharing slang. A common challenge that students encounter when entering tertiary education is adapting to an unfamiliar environment. Within this territory, they are compelled to establish a new social identity and a sense of group belonging, with slang potentially aiding undergraduate students to navigate the complexities of interactions among peers and staff members.

### Objective

This study examined the phenomenon of slang in Malaysia with three objectives: (i) to explore the perceived functions of slang in everyday communication, (ii) to investigate its effects on group membership, and (iii) to identify common types of slang used.

### Methods

This study adopted a qualitative research design, centring on phenomenological analysis. Data were collected through Google Forms and a focus group discussion with seven undergraduate students from SEGi College Penang on two separate occasions, using a semi-structured protocol. The interview transcripts were analysed using thematic analysis.

### Results

The findings reinforced the dual-property nature of slang, functioning as both an indicator of inclusion and exclusion in group membership. Beyond its nature, slang functions to express emotions, provide entertainment, convey disagreement, and promote social acceptance. While participants reported greater familiarity with contemporary slang expressions, their use of slang was associated with a specific context, suggesting there is a time and place for a light-hearted choice of words.

### Conclusion

Slang is ever-evolving, making each study relevant to a specific time period. The findings are expected to contribute to the growing awareness of the younger generation's preferred communication style and introduce an affective dimension, such as anxiety, to linguistic behaviour.

**Keywords:** *Palm oil fractions, plant-based meat analogue, consumer acceptability, texture profile analysis*

## Understanding the Pathways Between Social Exposure and Susceptibility to E-Cigarette Use Among Malaysian University Students: A Structural Equation Modelling Approach [Poster: A0162]

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### Introduction

Social influence is an important determinant of e-cigarette (EC) use among young adults; however, the relationships between social influence, perceived health risk and susceptibility to EC use remain unclear. Understanding these relationships is important for developing evidence-based prevention strategies targeting young adults.

### Objective

This study aimed to examine the relationship between social influence, perceived health risk and susceptibility to EC use among Malaysian university students.

### Methods

A cross-sectional survey was conducted between June and December 2025 among non-current EC users recruited through convenience sampling from five public research universities across the northern, central and southern region of Peninsular Malaysia. Participants reporting any indication of intention, willingness or curiosity were classified as susceptible to EC use. Social influence, perceived health risk and susceptibility to EC use were modeled as latent constructs. Confirmatory factor analysis (CFA) was conducted to assess the measurement model, followed by Structural Equation Modelling (SEM) using R to examine the relationships among the study.

### Results

A total of 1,000 university students participated in the study, most were female (65.7%), of Malay ethnicity (62.8%), and enrolled in undergraduate programmes (89.6%), with an average age of 21.8 years. Overall, 30.0% of participants were susceptible to EC use. The structural model demonstrated excellent fit (CFI = 0.995, TLI = 0.991, RMSEA = 0.034, SRMR = 0.014). Social influence from friends and family members was a significant positive predictor of university students' susceptibility to e-cigarette use ( $\beta = 0.511$ ,  $p < 0.001$ ), whereas perceived health risk was negatively associated with susceptibility ( $\beta = -0.207$ ,  $p < 0.001$ ). Social influence was not significantly associated with perceived health risk ( $\beta = 0.002$ ,  $p = 0.968$ ), indicating that the hypothesized indirect pathway through perceived risk was not supported. Overall, the model explained 30.3% of the variance in susceptibility to e-cigarette use.

### Conclusion

Social influence from friends and family members was strongly associated with greater susceptibility to EC use among Malaysian university students whereas higher perceived health risks were associated with lower susceptibility. These findings suggest that EC prevention programmes should address peer and family influences while strengthening students' awareness of the health risks associated with EC use.

**Keywords:** *E-cigarette use, susceptibility, peer influence, health risk perception, Malaysian university students*

## SYMPOSIUM TRACK 4: MEDICAL & VETERINARY SCIENCES

### Comparative Evaluation of Aqueous and Ethanolic *Clinacanthus nutans* Extracts on Cell Viability, Proliferation and Survival in Human Breast Cancer Cell Lines [Poster: A0063]

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#### Background

*Clinacanthus nutans* (CN) has gained increasing attention due to its diverse pharmacological properties, including antioxidant, anti-inflammatory and anticancer activities. Nevertheless, limited information is available on how different extraction solvents influence the antiproliferative and cytotoxic effects of *Clinacanthus nutans* extracts in breast cancer cell lines.

#### Objective

Therefore, this study aimed to compare the effects of aqueous and ethanolic CN extracts on cell viability, proliferation and survival activities in human breast cancer cells.

#### Methods

Human breast cancer cell line (MCF-7) was treated with various concentrations of aqueous and ethanolic of CN for 48 hours. Cell viability and proliferation were assessed using a CCK-8 assay, while cell long-term survival was evaluated using a survival assay. Comparative analysis was performed to determine the differential effects of both extracts on MCF-7 cells.

#### Results

Both CN extracts exhibited concentration-dependent inhibitory effects on breast cancer cell viability and proliferation. The ethanolic extract demonstrated significantly greater short-term cytotoxicity than the aqueous extract ( $p < 0.05$ ), with  $IC_{50}$  values of  $25\mu\text{M}$  and  $65\mu\text{M}$ , respectively, after 48h of treatment. However, the clonogenic assay revealed that cells treated with the ethanolic extract retained a higher long-term survival fraction than those treated with the aqueous extract, indicating that although the ethanolic extract produced stronger initial growth inhibition, the aqueous extract was more effective in suppressing long-term clonogenic survival.

#### Conclusion

In conclusion, the extraction solvent significantly influenced the biological activities of CN against human breast cancer cells. While the ethanolic extract exhibited greater short-term antiproliferative and cytotoxic effects, the aqueous extract showed stronger inhibition of long-term clonogenic survival. These findings suggest that the biological activity of CN is assay-dependent and may involve multiple mechanisms of action. Further studies are required to elucidate the molecular pathways underlying these differential effects, including investigations using additional breast cancer cell models with different receptor statuses.

**Keywords:** *Clinacanthus nutans*, breast cancer, cell viability, proliferation, cell survival

### Monitoring Hand Hygiene Practices Among In-school Adolescents in Support of the WASH in Schools (WinS) Programme: A Decade of Evidence (2012–2022) [Poster: A0165]

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#### Background

Hand hygiene is an effortless yet efficacious measure for preventing the transmission of communicable diseases among school-aged populations. The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) advocate the Water, Sanitation and Hygiene (WASH) in School programme (WinS) to promote healthy school environments through improved water, sanitation, hygiene facilities, and sustained behavioural change. Monitoring adolescents' hand hygiene practices over time is essential for evaluating progress towards WinS objectives.

#### Objective

This study examined decade-long trends in hand hygiene practices with association with risky lifestyles, mental health status and peer support among in-school adolescents from 2012 to 2022 in Malaysia.

#### Methods

A longitudinal analysis was conducted using National Health and Morbidity Survey (NHMS) collected in 2012, 2017, and 2022 among in-school adolescents. All surveys employed validated self-administered bilingual (Malay and English) questionnaires to assess health behaviours including hygiene, mental health status, and risk-related behaviours among adolescents. Complex sample analysis was conducted to estimate the prevalence of inadequate hand hygiene and logistic regression was used to identify associated factors using SPSS version 31.

#### Results

The prevalence of inadequate hand hygiene decreased from 51.3% (50.5%, 52.1%) in 2012 to 40.6% (39.3%, 41.8%) in 2022, assuming 2 out of 5 adolescents were considered inadequate practice after 10 years review. Regression showed male gender, Chinese and Indian ethnic, current alcohol drinker, physical inactive, inadequate oral hygiene practice and lack of peer support were factors found to be associated with inadequate hand hygiene throughout the year.

#### Conclusion

Good hand hygiene practices among in-school adolescents demonstrated an improving trend over the past decade. Continued investment in school-based hygiene promotion, behavioural interventions, and equitable access to handwashing facilities is needed to sustain healthy practices. These findings provide valuable evidence for monitoring progress towards the WHO/UNICEF WASH in Schools (WinS) programme and supporting policies that promote healthier school environments.

**Keywords:** *WASH in Schools (WinS) programme, adolescents, school, hand hygiene*



## Mitragynine Alleviates Mechanical Hypersensitivity in a Chronic Constriction Injury (CCI) Rat Model of Peripheral Neuropathy [Poster: A0177]

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### Background

Conventional opioid therapies for severe pain carry high risks of tolerance and addiction. Mitragynine, a kratom-derived indole alkaloid, exhibits opioid-like anti-nociceptive and anti-allodynic properties with a comparatively lower withdrawal liability. This study evaluates mitragynine's potential as a safer alternative analgesic for treating complex peripheral neuropathy.

### Objective

To investigate the anti-allodynic effect of mitragynine in a peripheral neuropathic pain rat model.

### Methods

Peripheral neuropathy was induced in Sprague Dawley rats (N=9) using a Chronic Constriction Injury (CCI) model. Rats were randomized into Sham, CCI, and CCI+MIT groups (n=3/group). CCI rats underwent two ligations on the right sciatic nerve. Meanwhile, sham rats received identical surgical exposure without ligation. Sham and CCI groups received vehicle (20% Tween 80, i.p.), while the CCI+MIT group received mitragynine (15 mg/mL, i.p.). Mechanosensitivity was assessed by measuring the paw withdrawal threshold (PWT) of both paws using the simplified up-down method with von Frey filaments. PWT was evaluated pre-operatively (day -3) and post-operatively (days 3, 5, and 7). To evaluate acute efficacy, PWT was measured at pre-treatment and 30 minutes post-treatment on day 7.

### Results

Baseline PWT were consistent across all groups prior to surgery. By post-operative days 5 and 7, the CCI and CCI+MIT groups exhibited a significant reduction ( $p < 0.05$ ) in PWT in the ipsilateral paws compared to sham-operated rats, confirming the successful induction of mechanical allodynia. On day 7, mitragynine significantly reversed the mechanical hypersensitivity to near-sham level ( $p > 0.05$ ) after 30 minutes of mitragynine administration, suggesting a profound acute anti-allodynic effect. Whereas the CCI group remained in a severe allodynia state. Contralateral paws in all groups remained unaffected except for the CCI group.

### Conclusion

Mitragynine exhibits significant acute anti-allodynic efficacy in CCI rat model, underscoring its potential as a viable, alternative analgesic for the management of peripheral neuropathic pain.

**Keywords:** Mitragynine, peripheral neuropathy, mechanical allodynia

## Growing Up Safe? A Decade-Long Analysis of Unintentional Injuries Among In-School Adolescents [Poster: A0186]

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### Background

Unintentional injuries remain an underlying cause of morbidity and mortality among adolescents worldwide, contributing substantially to healthcare utilization, school absenteeism, and reduced quality of school lives. Despite ongoing injury prevention initiatives, evidence on long-term trends of adolescent injuries among in-school adolescents remains limited, particularly in Malaysia. Monitoring changes in injury occurrence over time is essential for evaluating prevention efforts, identifying vulnerable populations, and informing school health policies.

### Objective

This study examined decade-long trends in unintentional injuries among in-school adolescents between 2012 and 2022.

### Methods

A longitudinal analysis was performed using National Health and Morbidity Survey (NHMS) using 2012, 2017, and 2022 in-school adolescents' data. Information on unintentional injuries sustained during the previous 12 months was obtained through standardized self-administered bilingual (Malay and English) questionnaires. Complex sample analysis was conducted using SPSS version 31.

### Results

The prevalence of unintentional injury decreased from 34.5% (33.7%, 35.3%) to 20.4% (19.5%, 21.3%), about 14% reduce prevalence throughout 10 years review. The results found fall was the major cause of injury with the decrease trend from 12.2% (11.7%, 12.8%) in 2012 to 9.1% (8.6%, 9.7%). However, highest prevalence was found in 2017 with 20.6% (19.7%, 21.5%). The findings also found increases prevalence of bone fracture / dislocation from 4.4% (4.1%, 4.7%) in 2012 to 4.7% (4.4%, 5.1%) and prevalence of cut or open wound 7.0% (6.6%, 7.4%) in 2012 to 8.8% (8.3%, 9.3%).

### Conclusion

Although the prevalence of unintentional injury reduces, the prevalence of cut or open wound and bone fracture / dislocation was increased. Strengthening school-based injury prevention programmes, promoting safe environments, and implementing targeted interventions for high-risk groups are essential to reduce injury burden. Continuous surveillance is needed to monitor trends, evaluate prevention strategies, and support evidence-informed adolescent health policies.

**Keywords:** Adolescents, unintentional injuries, school

## SYMPOSIUM TRACK 5: COMPUTER SCIENCE & MATHEMATICS

### Automating Early-Stage Renewable Energy Siting: An AI Assisted Geospatial Decision Support Framework for Small Hydropower at Sungai Perak Catchment [Poster: A0138]

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#### Background

Increasing the share of renewable energy in the global energy mix is essential in achieving UN Sustainable Development Goal (SDG) 7, which aims to ensure access to affordable, reliable, sustainable and modern energy. However, initial site selection processes for renewable energy projects remains a complex and resource-intensive process due to fragmented spatial datasets, numerous technical and environment constraints and heavy reliance on expert judgement.

#### Objective

This study presents a framework for the development of a Decision Support System (DSS) for Small Hydropower (SHP) site selection, which integrates Geographical Information System (GIS), Multi-Criteria Decision Analysis (MCDA) and Large Language Model (LLM) capabilities. The framework aims to improve the efficiency, consistency and transparency of early-stage SHP site screening while reducing dependence on manual expert evaluation.

#### Methods

The proposed DSS utilizes a modular agent-based architecture, where spatial datasets are integrated using GIS and deterministic screening is conducted against predefined mandatory, rejection, and preference criteria. Suitable candidate sites are subsequently identified with explainable technical dossiers generated by the LLM module that summarizes the evaluation results and supporting evidences to facilitate transparent decision-making.

#### Results

A prototype of the DSS is currently under development, focusing on the Sungai Perak catchment as a pilot study. Several agents have been developed to evaluate the datasets provided such as geology and distance to substations. Initial testing has successfully demonstrated the automated execution of the screening, scoring and report generation modules.

#### Conclusion

The current stage of the pilot study has successfully demonstrated the feasibility of integrating GIS-based spatial analysis, MCDA and LLM-assisted explainability. Although still in its early stages of development, the system demonstrates a significant step toward integrating AI-driven decision support into traditional site selection process, offering a path toward the next generation of automated early-stage site selection.

**Keywords:** GIS, LLM, hydropower, siting

### Design and Management of a Scalable Translation Database for AI-Driven Language Ecosystems [Poster: A0021]

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#### Background

The rapid evolution of Artificial Intelligence (AI) has necessitated the creation of specialized data management systems capable of handling massive linguistic datasets. The MyTRANSLATE initiative represents a multi-disciplinary effort to modernize translation services, developed by a group of researchers at Universiti Teknologi Malaysia in collaboration with Institut Terjemahan & Buku Malaysia (ITBM). The backend database module developed for MyTRANSLATE serves as the core infrastructure supporting neural machine translation services. Without a robust data foundation, advanced translation models fail to reach optimum performance.

#### Objective

The module is defined by its role in maintaining data integrity, accessibility, and scalability. Over a 24-month duration, it aims to integrate disparate data sources into a unified parallel corpus, supporting the broader goals of the MyTRANSLATE ecosystem which includes linguistic analysis, model training, and user interface development.

#### Methods

The module follows a rigorous data management path: Data Collection, Data Processing, Database Construction, Integration and Migration, Validation Test and Documentation. For data integration, API-driven ETL pipeline is used to replace traditional batch processing. This API layer facilitates the ingestion of heterogeneous data sources into the structured SQL environment.

#### Results

The module serves as the bridge between several other sub-modules which are: Module 1: Primary feed of raw data, Module 2: Provides the linguistic context needed for metadata tagging, Module 4: Consumes the cleaned data for NMT and model training, and Module 5: Provides the end-user interface that queries the database. The architecture that resulted from the module's integration efforts achieves a Technology Readiness Level (TRL) of 8, ensuring stability, security, and high-performance data delivery for AI-driven translation tasks.

#### Conclusion

The MyTRANSLATE backend is a sophisticated ecosystem that transcends traditional database management. By combining structured SQL storage with API-driven ingestion and vector-based semantic retrieval, the system provides the "Backbone" required for next-generation translation. The study successfully establishes a smart, competitive foundation that ensures data security, integrity, and operational excellence.

**Keywords:** Database management, API driven integration, neural network translation

## INNOVATION COMPETITION

| Presentation Code   | B001                                                                                                                                                           |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic/Project Title | Stability and thermal conductivity performance of water-based hybrid nanofluids using cellulose nanoparticles from oil palm biomass/metal oxide nanocomposites |
| Category and Scope  | Sustainability/Green and Biology & Chemistry                                                                                                                   |
| Leader              | Mageswari Manimaran                                                                                                                                            |
| Team member         | ChM. Dr. Mohd Nurazzi Norizan                                                                                                                                  |
| Institution         | School of Industrial Technology, Universiti Sains Malaysia                                                                                                     |

| Presentation Code   | B002                                                                                                                                                                                             |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic/Project Title | Synergistic Functionalization of Cellulose Nanofiber Sponges via TEMPO Oxidation and PEI-Citric Acid Crosslinking for Efficient Heavy Metal Removal from Raw Water in Kerian River, Pulau Pinang |
| Category and Scope  | Sustainability/ Green and Physics & Engineering                                                                                                                                                  |
| Leader              | Mageswari Manimaran                                                                                                                                                                              |
| Team member         | Muhammad Adlan Azka                                                                                                                                                                              |
|                     | ChM. Dr. Mohd Nurazzi Norizan                                                                                                                                                                    |
| Institution         | School of Industrial Technology, Universiti Sains Malaysia                                                                                                                                       |

| Presentation Code   | B003                                                                                        |
|---------------------|---------------------------------------------------------------------------------------------|
| Topic/Project Title | SAFE-GAS                                                                                    |
| Category and Scope  | Product/ Prototype and Physics & Engineering                                                |
| Leader              | Mohd Anas Ahmad                                                                             |
| Team member         | Nur Atiqah Binti Hamzah                                                                     |
| Institution         | Institute of Nano Optoelectronics Research and Technology (INOR), Universiti Sains Malaysia |

| Presentation Code   | B004                                                                              |
|---------------------|-----------------------------------------------------------------------------------|
| Topic/Project Title | Gene Therapy – Precise Therapeutic Product to Eradicate HIV                       |
| Category and Scope  | Product/ Prototype and Biology & Chemistry                                        |
| Leader              | Nur Diyana Zulkifli                                                               |
| Team member         | Dr Kalidasan Vasodavan                                                            |
| Institution         | Institute for Research in Molecular Medicine (INFORMM), Universiti Sains Malaysia |

| Presentation Code   | B005                                                                                                                                                      |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic/Project Title | Driving Semiconductor Innovation Through INOR Gallium Nitride Template: Advancing High-Quality GaN Epitaxy for Next-Generation Semiconductor Applications |
| Category and Scope  | Product/ Prototype and Physics & Engineering                                                                                                              |
| Leader              | Mohd Anas Ahmad                                                                                                                                           |
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| Institution         | Institute of Nano Optoelectronics Research and Technology (INOR), Universiti Sains Malaysia                                                               |

| Presentation Code   | B006                                                                                               |
|---------------------|----------------------------------------------------------------------------------------------------|
| Topic/Project Title | CRISPR-EDU: An Educational CRISPR Workflow and Guide RNA Design Platform for Learning and Research |
| Category and Scope  | Software/ App/ Ai and Biology & Chemistry                                                          |
| Leader              | Matthew Tze Jian, Wong                                                                             |
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| Institution         | Institute for Research in Molecular Medicine (INFORMM), Universiti Sains Malaysia                  |

| Presentation Code   | B007                                                                                                                     |
|---------------------|--------------------------------------------------------------------------------------------------------------------------|
| Topic/Project Title | VIBRIOtrace: An eDNA-Based Multiplex Real-Time PCR Platform for Early Surveillance of Major Aquaculture Vibrio Pathogens |
| Category and Scope  | Product/ Prototype and Biology & Chemistry                                                                               |
| Leader              | Noorizan Binti Miswan                                                                                                    |
| Team member         | Lau Nyok Sean                                                                                                            |
|                     | Nur Ain Binti Mohamed Hussin                                                                                             |
| Institution         | Centre for Chemical Biology CCB, Universiti Sains Malaysia                                                               |

| Presentation Code   | B008                                                                                                                                                                                                   |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic/Project Title | SSEDAR: Empowering Highland Farmers in Sustainable Slope Management Through Data-Driven Social Innovation                                                                                              |
| Category and Scope  | Sustainability/ Green and Biology & Chemistry                                                                                                                                                          |
| Leader              | Siti Norhafizah binti Ahmad Tarmidzi                                                                                                                                                                   |
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| Institution         | Taman Botani Bangi, Fakulti Sains & Teknologi, Universiti Kebangsaan Malaysia                                                                                                                          |



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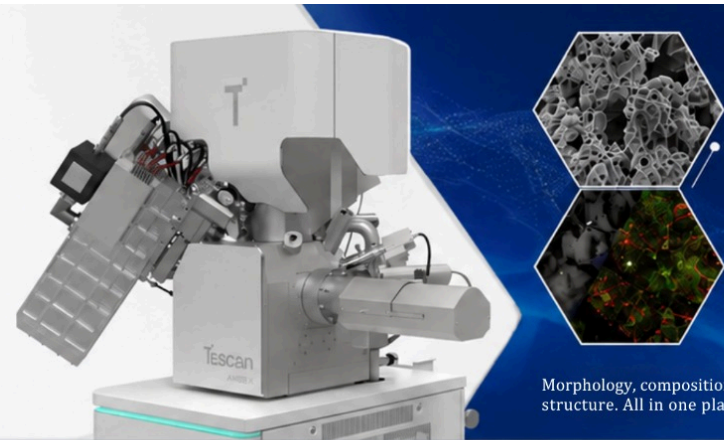
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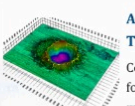
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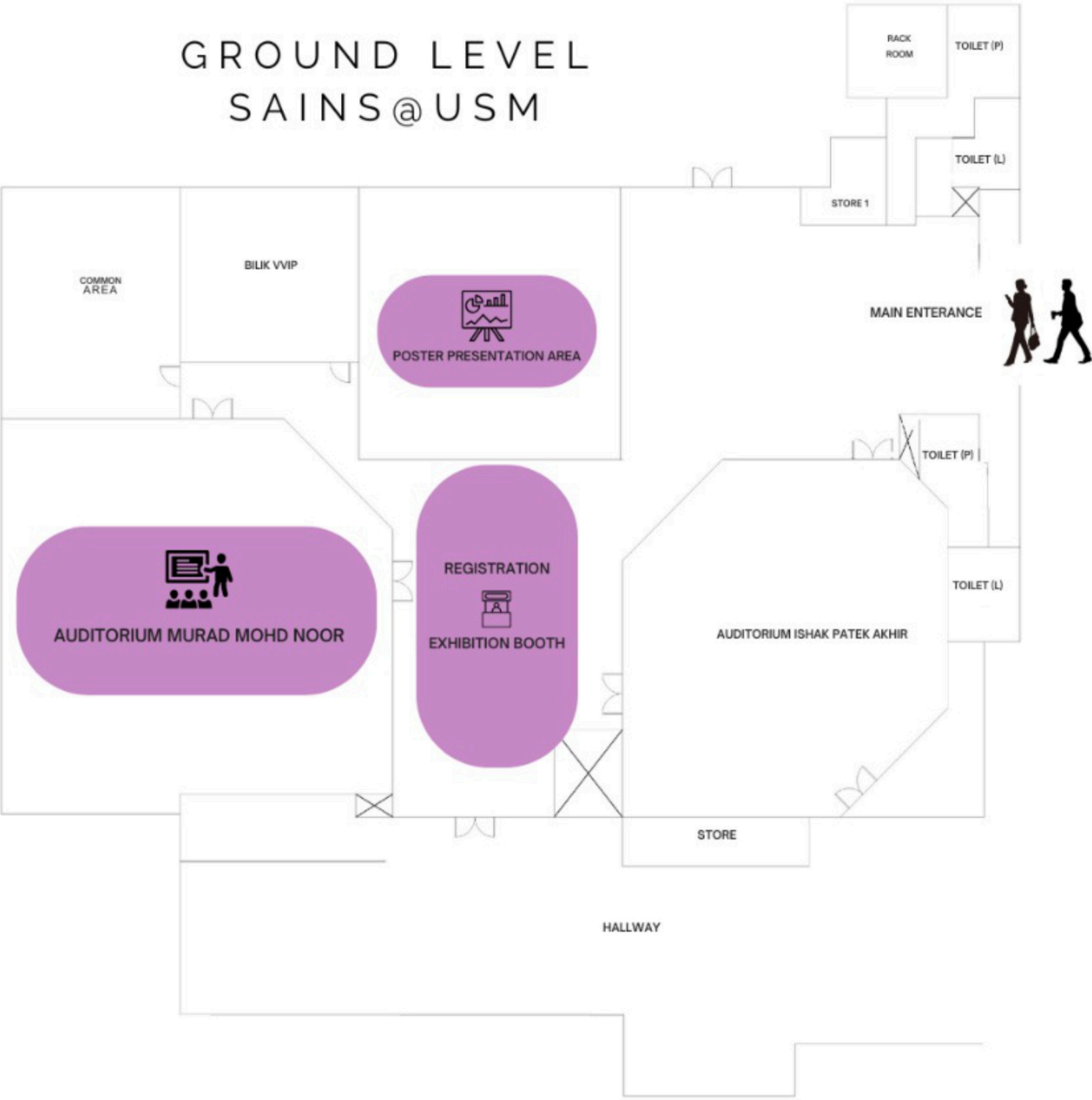
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