

MRUN

Malaysia Research University Network

BULLETIN



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KEBANGSAAN
MALAYSIA
*The National University
of Malaysia*



UPM
UNIVERSITI PUTRA MALAYSIA



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DISEMBER 2017



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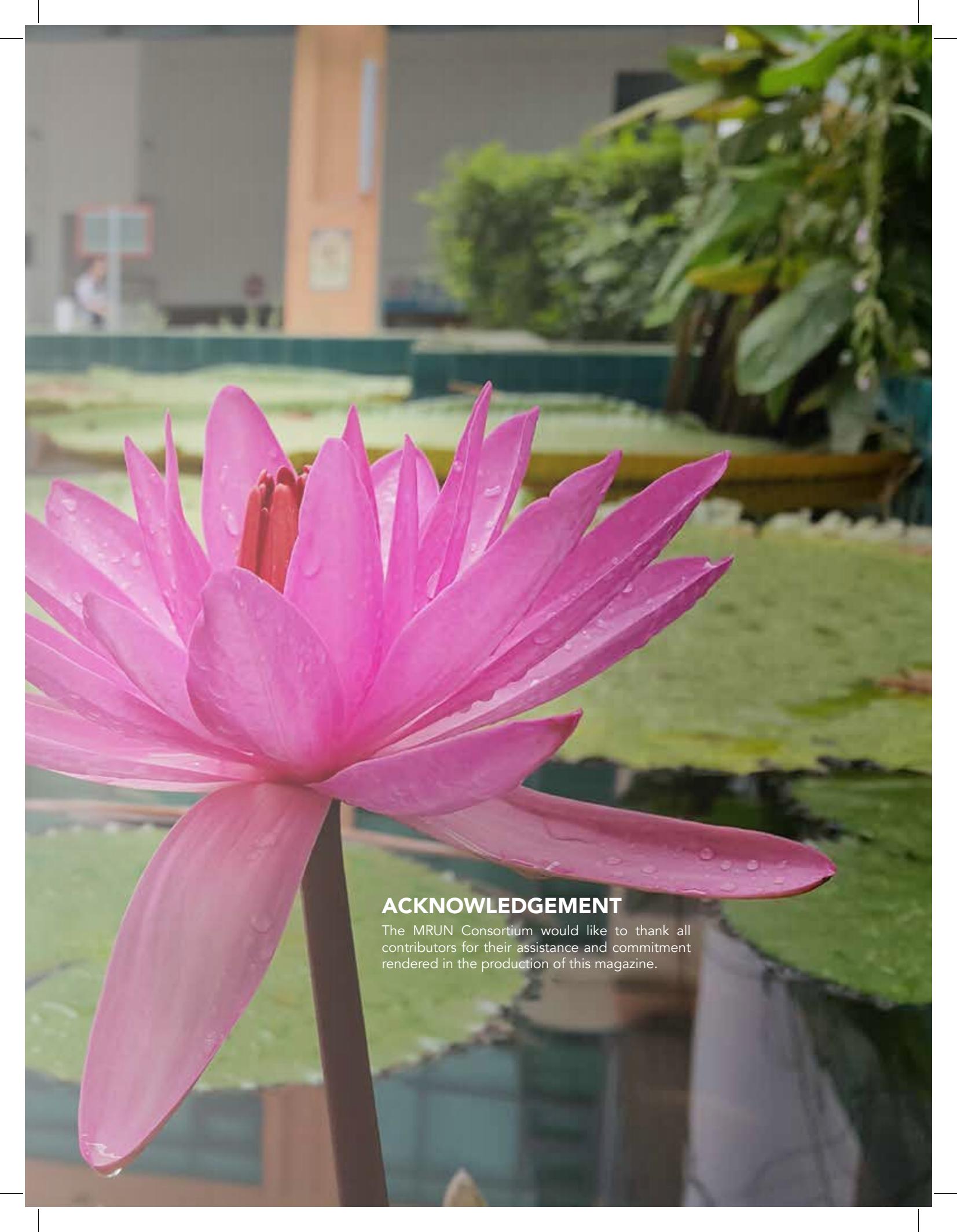
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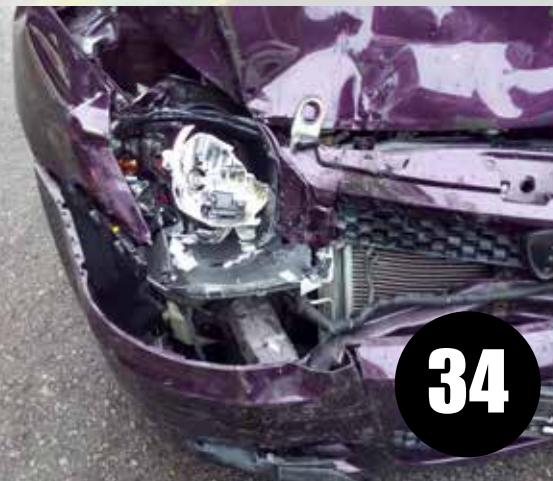
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FOREWORD

This inaugural issue of MRUN Bulletin which focuses on translational research is a timely effort. Since UM, USM UKM, UPM and UTM were declared as research universities, we have not been overtly seen as a consortium that thrives as a single unit. There have been various collaborations between the research universities, but they were carried out based on the initiatives of individual scholars, working on specific research grants that require collaborative effort. With the establishment of Malaysia Research Universities Research Network (MRUN), the five universities aim for visibility as a cohesive group, whose combined strengths in various disciplines can reap better gains nationally and internationally.

This maiden issue focuses specifically on translational research. In his annual address this year, the Minister of Higher Education, Dato' Seri Haji Idris bin Jusoh announced 2017 as the Year of Translational Research. Through translational research, Dato' Seri Haji Idris emphasizes that universities could play a role to benefit industry, academics, government and society in general.

Translational research is a familiar term in medical parlance. Its term is used widely to refer to "the bench to bedside and bedside to bench" ecosystem for the benefit for the society at large. All our research activities should bring about improvements for the well-being of humanity. It is important to translate our research that is oriented towards providing solutions for our society's pressing demands. Based on predictions of future problems such as aging population, marked increase of uncommunicable disease, rise of earth's temperature, how can we tailor our research so that we are not only generating new knowledge, but at the same time, we use our knowledge and innovations to nurture growth and well-being of the nation, its diverse communities and industries? There have been many examples of translational research already carried out, but the declaration of 2017 as the Year of Translational Research highlights its pressing agenda. The impact of each research should resonate with the needs of communities of industries.

I would like to thank the team involved in producing this first issue. The articles in this volume provide insights into the kinds of translational research carried out at various research universities. Together, as a consortium, we will grow from strength to strength, and execute our function as one of the primary drivers of knowledge economy, bridging gaps between various stakeholders for the betterment of our lives.



PROF. DATUK DR. ASMA ISMAIL, FASC
Chair of Malaysia Research University Network



5.

Cross-regional trade (CRT) between 'non-natural' (modest trade and geographically distant) trade partners has transcended intra-regional trade, as countries that have exhausted their gains or potentials within regional boundaries seek to secure new/alternative world markets CRT or the "new bilateralism", appears to be at odds with traditional theories of regionalism that emphasize geographical and cultural proximity.

Importantly, the current context of bilateralism provides countries such as Malaysia and Chile the chance to scale up their partnership and fashion new trade scenarios within the broader framework of the Association of Southeast Asian Nations (ASEAN) and the Pacific Alliance (Chile, Colombia, Mexico and Peru) bloc-to-bloc cooperation. Since market rationalist reasons such as market access and trade facilitation underscores CRT, more work through single-case studies of 'unnatural' trade partnerships is needed to advance arguments on potentials and barriers to CRT.

In short, bilateralism is important to understand the economic gains from specific industries that underlie CRT, and to appraise the importance of regulatory environment for promoting trade.

On the basis of the Malaysia-Chile partnership, the study identified situations that stakeholders (trade-related governmental organizations and exporters' associations) see as restrictions to their ability to participate effectively in CRT. The main challenge identified within specific sectors from both sides relate mainly to procedures set to secure compliance.

They mostly indicate adherence to labeling requirements for food products. The study found that to move forward the Malaysia-Chile partnership, there should be streamlining of cross-regional technical regulations to facilitate trade, and the investment-trade linkage needs strengthening for businesses to exploit complementarities. The alignment of non-tariff measures (NTMs) that are less transparent and difficult to quantify is also important for cross-regional transactions as that for regional trade, and therefore should occupy the national trade policy agenda.

6.

Cross Regional Trade – Relationship **Malaysia-Chile**



CHILE



MALAYSIA

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Combating Thalassemia Through Human Genomics Research

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This RUT grant headed by Professor Zilfalil Alwi began on 1st February 2013 and was completed on 31st January 2016. The project was divided into six multidiscipline (Hematology, Genomics, Psychology, Health Economics, Ophthalmology, Dental) involving national and international institutions namely UM, UKM, UPM, Ministry of Health (HKL, IMR) and Mahidol University, Thailand. Numerous achievements including international collaborations and recognition, publications and human capital development were accomplished from this project.

The greatest achievement was the subsequent establishment of the Global Globin 2020 Challenge (GG2020), a global project that seeks to apply recent developments in human genomics, to fight haemoglobinopathies in developing countries. GG2020 was accorded the status of an NGO official partner of UNESCO with a participation of more than 50 members from 32 countries.

This collaboration led to a project with QuantuMDx, a private company based in UK, in producing a rapid (less than 20 minutes) GG2020 Thalassemia kit that will be internationally commercialized.

Other international research collaborators include Beijing Genome Institute (BGI) and Tribhuvan University, Nepal. The Eduvariome Program is a community program established to promote awareness on thalassemia which involved thirteen schools and universities across Malaysia.

It is hoped that thalassemia can be eradicated or reduced significantly. The Eduvariome Program was established to promote awareness on thalassemia among school and university students. A total of thirteen schools and universities were involved in this community program.

The GG2020 Meeting was held at UNESCO Headquarters in Paris. GG2020 is an NGO official partner of UNESCO with a participation of more than 50 members from 32 countries.



The Invisible Children of Kampong Tagupi, Lahad Datu

Their story...

They are Malaysian born yet stateless due to unregistered births. The cycle continues to the following generations producing more and more undocumented population. Being undocumented, they are deprived almost all basic government privileges, especially education. They don't exist. They can't vote. They are labelled as 'pendatang tanpa izin'. Almost all of them have never seen life outside their village because they are afraid to leave their 'kampong'.

The children do not have activities nor plan for the future before the so-called 'school' was built by HALUAN - an NGO dedicated to provide education for them. There are 7 such schools, for 1100 children/teenagers, taught by around 40 teachers. These are volunteer teachers receiving very minimal allowances and are mostly local, trained by a few dedicated qualified volunteer teachers.

Our team and ten dedicated officers from the Ministry of Education, decided to do our part. It took us three hours by car from Lahad Datu town to reach this village. We brought books, papers, and pencils for the children. We also had a training session for the teachers and a fun motivational session for the parents. Overall, our message was that we care and they should not give up.

The truth is, it's not within our power nor jurisdiction to give them what they needed the most – identification documents - to be recognized and to receive the same privileges as all other Malaysians. Fortunately, the Yang Berhormat that came with us promised that he will bring forward their plight to the relevant ministries and give them the freedom that is rightfully theirs.

Education for All is a policy designed for these people. Let's ensure the policy is soundly implemented as it should be.

Their voices...

I am 16 years old, I have just finished my Year 6. I am not sure what to do next...

My father has his identification card. He came to this village when he was young. I don't have documents because back then my father was too poor to leave this village to register my birth. Without document, I cannot register my marriage. So, all my children do not have documents too. We never leave this village because we might get caught. We don't exist. Please help us.

I have a birth certificate. But I was in my 20's when I applied for my identification card. My application was rejected. They want more documents. But I don't have the money to keep on going to town. I gave up.

Different versions, different stories but similar situations with the same hope and request - help their children to transform their future or, to at least have a future.

Acknowledgement,

Our deepest gratitude to Educational Planning and Research Division, MoE and HALAJU for allowing us to be part of the team.

Drinking water Threat

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Drinking enough water is essential to replace the large amounts of water lost each day from our body. But drinking water, including bottled water may reasonably contain at least small amounts of some unknown contaminants, especially endocrine disrupting compounds (EDCs). This statement is proven when EDCs were observed across the drinking water supply of 28 million Americans even though United States is known for having very high quality of tap water with an incredible water treatment, storage and distribution.

Consumers should be aware that EDCs can be found in everyday products such as detergents, toothpastes, cosmetics, food and beverage cans, kitchenware and plastic toys. Furthermore, many water treatment facilities particularly the conventional one has relatively low capability in removing these chemicals. The existence of EDCs in drinking water is of great concern as EDCs can have serious adverse health impacts in low doses. The health problems including

the commonly known diseases such as cancer, diabetes and obesity.

Also, a study reported infants and children, which entails greater drinking water consumption on a body-weight basis, could have approximately 6 times greater exposure and risk than those in adolescence and adulthood. Currently, the inadvertent exposure to EDCs via drinking water consumption and the associated risks may have been underestimated and subsequently not investigated because of the incompetent water monitoring and management.

The World Health Organization (WHO) has also declared that the development of formal guideline values for EDCs in the WHO Guidelines for Drinking Water Quality is unwarranted. Should you still have concerns about sustainable access to safe drinking water, it is important to know that current environmental regulations and policy are under the threat of EDCs.





From Hobbyist to Entrepreneur

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MaGIC-X Official Launching Ceremony by Dato' Seri Mohd Najib Bin Tun Abdul Razak, Prime Minister

Collaboration with Medini



Innovation Hall at UTM, with investment from IRDA

MaGIC-X is part of the Johor state government agenda of digital economy entrepreneurship, apart from being the first gamification Centre of Excellence. Its presence is felt both locally via education mobile apps and interactive augmented reality, as well as globally via its close collaboration with Imagineering Institute, led by Adrian Cheok.

Its core business is very much aligned with the government's vision of redesigning higher education in various contexts, especially proactive teaching methodologies and more creative content delivery using cutting edge information technologies. MaGIC-X is no stranger in gamifying education. It has experience developing interactive content for Petronas Petroleum Technology Institute on Zero Tolerance and Centrifugal Oil Compressor.

MaGIC-X has since developed more than one hundred mobile applications for Android devices to stamp its mark in the digital world. In conjunction with the visit from the Minister of Higher Education on 10th August 2017, the Classroom of the Future concept was showcased and launched.



Seaweed Industry in Malaysia: Eco-Friendly and High Value-Added Products

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Red seaweed (Gelidium) has been introduced in combination with new cultivation technology (on-and off-shore) to boost the Malaysia seaweed industry. This creates an economic opportunity in developing a sustainable technology for cultivating seaweed.

Selection of red seaweeds are due to them being renewable and sustainable feed-stocks, having no conflict with food crops on arable land, requiring minimum chemical and energy during pulp processing and, capability of reducing CO₂ through photosynthesis.

The physical structure of Gelidium consists of mucilaginous materials (agar) and solid materials (pulp or fiber). Both of these materials can be converted to high value-added products, in order to create a high market value of this seaweed.

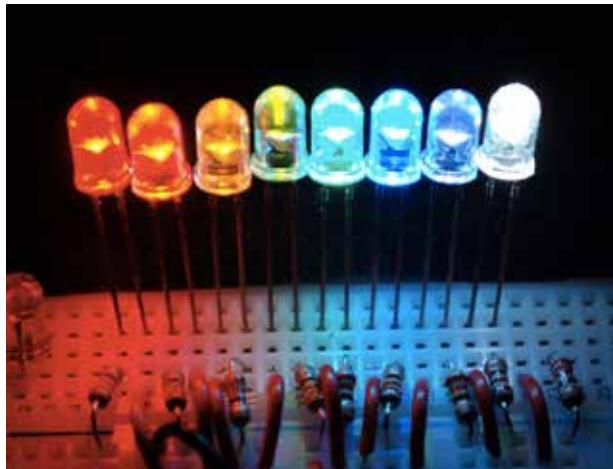
The unique feature with high absorptivity of pulp is desirable in making seaweed pulp separator to replace conventional polymer separator. The possibility of producing flexible, recyclable, non-toxic, and light weight battery devices made from red seaweed pulp is highly appealing. This new battery derived from high surface red seaweed pulp will be made of an environmentally salts as electrolyte via chemical deposition and impregnation. The market demand for the battery separator is greatly influenced by the increase of separator performance.

Therefore, it is promising to use red seaweed pulp as a tantalizing material for developing battery separator. This will not only bring Malaysia forward into new economic border by creating new market opportunities but also increase the income of the rural folks along the coastal area. Agar from seaweed can also be used as gel electrolyte for different type of batteries. The electrolyte produced from agar is a natural polymer and it is biodegradable, innocuous to human, environmentally friendly and inexpensive.

Smart Lighting Via Innovative Led Technology

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Ecologically sustainable and green technologies are the most highlighted subjects that influence life styles and global economic growth. New generation optoelectronic devices such as light emitting diodes (LEDs) promote excellent energy-efficiency and lower consumption of resources that finally yield lower green gas emissions. The LED is applicable in energy-saving lighting for buildings and automotives, backlight illumination with high color rendering index (CRI) for flat-panel displays (FPD), water and air purification system, advertisement display board, indicator in general electronic equipments, etc. By 2020, LED's global market value is to reach USD 87 billion.



The objectives of this program are to develop the human capital, and perform exploratory research for the next generation solid state lighting technology based on GaN-on-GaN LED, OLED, and novel LED devices.

- GaN-on-GaN LED epitaxy and development of bulk GaN will enable Malaysia to be at the forefront of a new technology which will revolutionize the current technology based on GaN on sapphire
- OLED technology will enable more players from industries in Malaysia to be at the front end manufacturing for development of lower cost SSL applications
- Novel LED structures utilize nanostructures for low cost, and energy efficient next generation optoelectronics

Next generation solid state lighting (SSL) will take advantage of emerging technologies: GaN-on-GaN LED, laser based lighting, and high brightness organic light emitting diodes (OLEDs). New materials are crucial in driving down the price tag and driving up market acceptance. SSL-LED industry is one of the most promising and upcoming market in the electronics industry.

To cater for this business, there is a pertinent need to develop our technology and human capital to be more technologically competent with the objective to become strategic key players as needed by the industry. The development of front end technology (epitaxy) is critically needed as epitaxy suppliers control the market and creates more competitive downstream players.





i-AHEAD: An Automatic Hearing Screening Device

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Hearing loss is the third most common chronic condition affecting the world population, children and adults. Early detection of hearing loss is essential for early intervention. However, most hearing-impaired individuals cannot access the limited hearing services resulting in delay in obtaining treatment.

Currently, hearing screening services especially in outreach programs are limited due to the limited number of trained personnel to conduct the test. The use of specialized equipment is also relatively costly. Furthermore, it is crucial to measure the environmental ambient noise levels to ensure the screening environment conform to the standard. To ascertain accurate results, the hearing screening test needs to be done in a mobile sound proof booth which is relatively expensive. The i-AHEAD is developed to overcome these problems.

The i-AHEAD is a computer-based hearing screening system with different user-friendly interfaces for self-test. The system will alert the user when the environment is noisy and not suitable for hearing screening to ensure valid test results. A modified headphone is used to give an even quieter environment for the hearing screening without the need for a soundproof room.

Among the participants' comments recorded: "it's easy and quick to screen hearing (Assistant Medical Officer, 20s)"; "very good (Retired medical lab technologist, 60s)"; "With this, I know about my hearing especially when age increases & as a housewife, this test is important to do because many people have hearing loss as their age increases (Housewife, 50s)"; Rarely seen in the public. The general public have not been exposed to this device (Worker, 60s)". Participants also gave their suggestions to improve the device. The i-AHEAD is currently in the process of commercialization.



Financial Sustainability for Institutions of Higher Learning Through WAQF

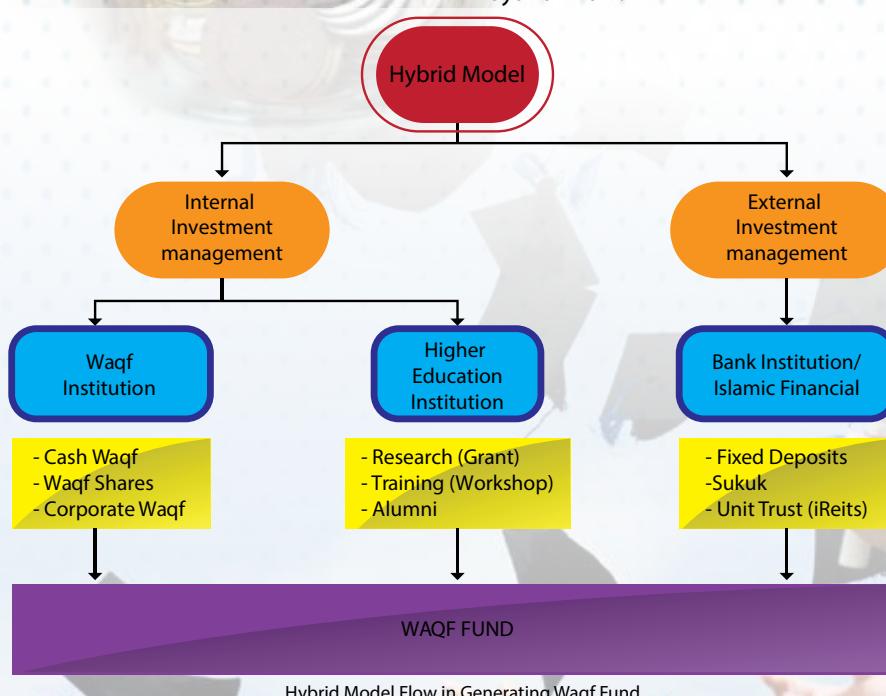
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WAQF is one of the most instruments to ensure sustainability of higher education in the country, especially in financing, development and provision of infrastructure. An institution needs the fund in order to realize their goal in achieving their mission and vision. In fact, the institution should develop their fund to continue their goal.

Hybrid Model is the element used by Harvard Management Company (HMC) towards Harvard University in realizing the endowment fund long term returns. This Hybrid Model method used the mix of internal and external expertise which was focused on a certain investment area. HMC used the combination of internal and external manager which was identified to be able in representing and implementing HMC's objective as well as providing the best strategic access (Management Investment HMC, 2015).

Therefore, Malaysia can use this method in generating higher education waqf as it is more efficient and systematic. In Malaysia, the combination concept of waqf fund investment management which is by dividing the duties to waqf institutions and Islamic banking institutions investing waqf fund should be used. Waqf institution as the expert in internal investment management that will generate waqf fund such as cash waqf, stock waqf, and waqf share. Whereas Islamic banking institutes as the expert in external waqf fund management that will generate waqf fund such as sukuk, fixed deposits and unit trusts.

When these two platforms are combined the waqf generating in Malaysia will improve and could establish a waqf university with a more efficient waqf fund. As mentioned above, the Hybrid Model method is very suitable to be applied in a higher education institutions' waqf generating system as long as it abides by the Islamic Syariah Law.



Drinking the Undrinkable

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Membrane water filtration system deployment in Kelantan



UTM's research in membrane technology has not only contributed to the scientific community but has also provided practical solutions to efficient and clean water fit for consumption. Portable membrane water filtration systems were developed locally and deployed to flood-prone regions in Malaysia, estimated to benefit about 10,000 flood victims at a time.

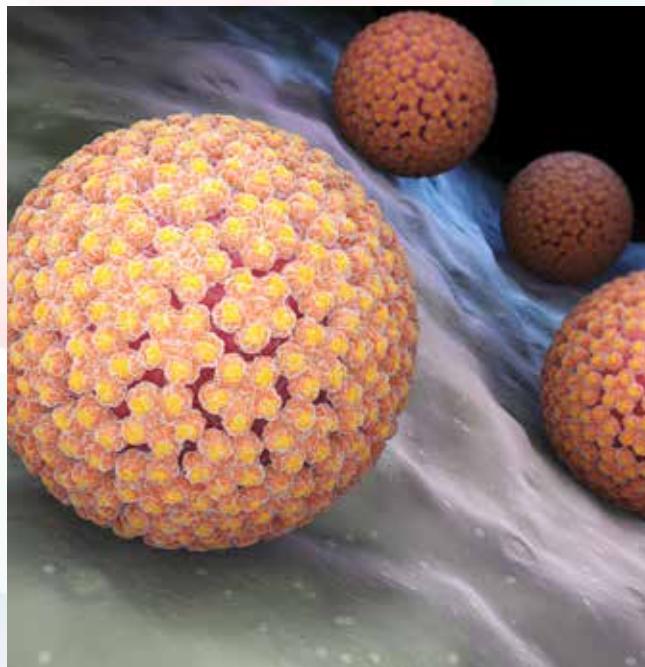
The research was backed heavily by the Ministry of Higher Education and the Ministry of Science, Technology & Innovation through various funding. Recently, the same team even managed to develop its first commercial desalination plant which is due to be commissioned in the east coast of Malaysia with ability to provide drinkable water for some 3,000 residents. UTM's membrane filtration system is periodically highlighted by MOHE as part of its blockbuster projects.



Next Gen membrane water filtration system in Ranau, Sabah

HPV Vaccination and Cervical Cancer Awareness Campaign: Am I Too Late?

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Fighting cervical cancer has been a nationwide program for decades in Malaysia as well as a global agenda. Societal awareness of primary and secondary prevention measures are still lacking, although this is the third most frequent cancer in female, as reported in the National Cancer Registry. A deadly disease, it is, however, preventable.

Nevertheless, most women present it late when curative treatment is always impossible. In Malaysia particularly, Pap smear screening, national HPV vaccination programs among school-going teenagers, and various campaigns have been carried out as a comprehensive initiative to curb this most 'scary-nightmare' among women. Unfortunately, the incidence and mortality rate have not decreased significantly, resulting in massive expenditure on cancer therapy and palliative support.

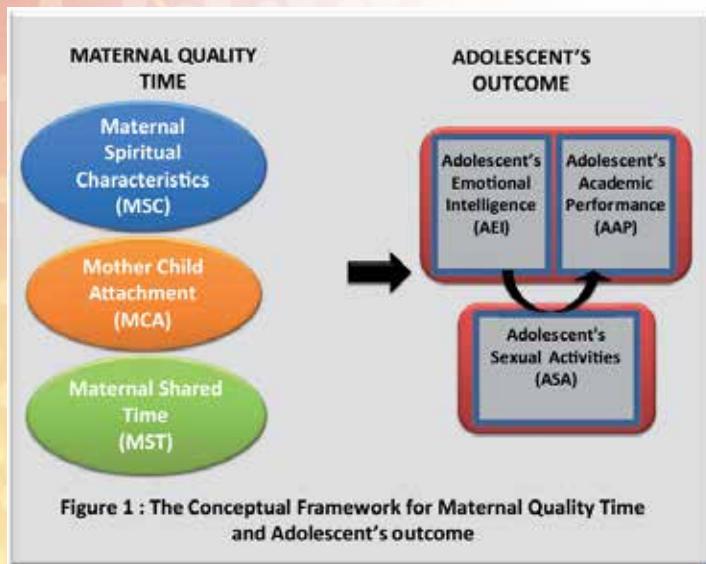
Two campaigns to raise awareness of Cervical Cancer and HPV vaccination were held in 2012 and 2015. These debut 'public-service programs' offered series of talk and forums, interaction with celebrity, games, poster presentations, demonstrations, counselling, free Pap smear screening and half-price HPV vaccine!

For the 2015 program, we were invited to studio Sri Pentas TV3 to air in 'Wanita Hari Ini' segment discussing about the topic. 3 million viewers tuned in the TV program.

The quadrivalent HPV vaccine does not only prevent cervical cancer in women but also genital cancer in men. It also prevents genital warts in both sexes. Hence, cervical cancer is preventable; we aim to continue educating the public so that cervical cancer no longer threatens women in the future.



Are Your Children Safe Online?



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The Internet is one such media source that more and more people, especially adolescents are using. According to the Malaysian Communication and Multimedia Commission (2008), the number of household Internet users in Malaysia is 2.5 million users, with the highest number coming from the pre-teens and teens (up to 19 years old) (17.9%), followed by 20 to 24 years olds (15.7%). It was also reported that 36.6% are students, mostly in secondary schools and college/university.

It was estimated that 4.2 million (12%) of all websites on the Internet are those related to sexual materials or pornography which 25 of them are more popular among the adolescents in Malaysia. Statistics from the Department of Social Welfare indicate that cases of child abuse, especially sexual abuse and neglect, have increased from 2,789 in 2009 to 3,428 in 2011.

Such sexually explicit websites of which adolescents are easily exposed to such materials has impacted some of them to become compulsive users. It is imperative that something must be done to curb such social ills. A framework has been developed to address the issue and enables effective cyber intervention using the Islamic psycho – spiritual method to address adolescent's cyber-sex compulsive users. Maternal piety and accountability were found to significantly influence on the adolescents' sexual misconduct.

Mother-child attachment was the key component of maternal quality time which positively influenced adolescents' emotional intelligence. Emotional intelligence comprises of four main components such as intrapersonal, interpersonal, spiritual and maturity.

This model which combines psychology, economy and Islamic disciplines will encourage quality maternal time between mother and daughter. It is a diagnostic model designed based on family counseling instrument for Muslim society (MSCS) and mother-daughter dyad counseling. This model is found to be valid and reliable inventory for adolescents.

This particular invention developed instruments called the Maternal Spiritual Characteristics Scales (MSCS) and Adolescent Sexual Conduct Inventory (ASCI) meant to offer intervention for the relapse prevention of adolescents' sexual misconduct via mother-daughter dyad counselling based on Islamic conceptions of maternal quality time. This instrument and module would be beneficial for counsellors in Malaysia in tackling of these issues. The Board of Counsellors Malaysia highlighted about 268 registered counsellors may be able to adopt this module.

Development of Sustainable Energy Source for Remote and Rural Communities

According to United Nations 1.6 billion people live in extreme poverty. Around 2.4 billion people rely on traditional biomass for cooking and heating purposes, and roughly a quarter of the world's population does not have access to electricity. Access to modern, safe and affordable energy and energy services is considered as one of the attributes having a great potential to reduce poverty. In addition, energy is one of the factors that can have an effect on majority if not all of the Millennium Development Goals (MDGs).

However this access still remains low. Authorities of developing countries, and business experts alike are increasingly moving into renewable energy sector. Although some renewable energy interventions have been able to support the local livelihoods, many have failed to reach sustainable results in the same quest. Malaysia is currently experiencing many changes especially in its energy sector. The country possesses a huge solar and hydropower potential of which only a small fraction is developed so far. The government of Malaysia is strongly committed to provide electricity for 99 percent of its citizens by 2020.

Worldwide experiences from large scale hydropower developments have shown many possible adverse impacts to the environment and people. The Ulu Gombak PV + micro hydro project can provide an alternative in electrifying rural areas of Malaysia, and furthermore through its support to livelihoods of local people, it can have an effect in reducing poverty.



Testing the micro hydro

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The Ulu Gombak micro hydro of 3kw combined with 2 kWp PV system have been developed by the Power Electronics and Renewable Energy Research Laboratory (PEARL) Department of Electrical Engineering, University of Malaya in collaboration with JPPHB of University of Malaya, the micro hydro provides power to the lab facilities (biology science lab) and also the Orang Asli community around the area.



Micro hydro in action, team from PEARL and JPPHB checking the functionality of the system



Micro Hydro Overall System

Merbok Forest Reserve: Harmonising Mangrove Biodiversity Conservation and Human Development

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Located in the state of Kedah is one of the most astounding mangrove ecosystems in the world. The Merbok Forest Reserve (MFR) covers an area of approximately 3000 ha of mangrove forest with 1000 ha of waterway flowing through it and is surrounded by a catchment area where the local community lives and generally depends on the ecosystem for its livelihood. It is home to the world's highest mangrove species diversity per unit area of contiguous landscape, comprising of over 30 of the 70 global true species and a few endangered ones. It also supports a whole multitude of faunal diversity.

As a mangrove ecosystem, it provides essential functions encompassing coastal fisheries, aquaculture and ecosystem services such as flooding and tsunami protection, carbon sequestration and pollution filtration. However, damage to these resources and the integrity of the ecosystem has accelerating due to increased unsustainable human practices and global climate change. Therefore, sustainable management of coastal biodiversity is required to preserve ecosystem function while securing sustainable livelihoods of the local community. Through a holistic approach involving ecology, genetics and socio-economic components the



USM mangrove research group are planning strategies to reconcile mangrove resources utilisation with human development.

This project has provided the leverage to a proposed global initiative of listing the site as a UNESCO Biosphere Reserve. These are sites established to promote and demonstrate a balanced relationship between human and biodiversity. The global network of over 600 BRs could assist our efforts in biodiversity conservation and improve community living standards through shared experiences and innovative technologies.

Our group successfully obtained three related national and a Newton-Ungku Omar Fund grants in recognition of the MFR study. We believe this initiative would propel the USM research group towards global recognition in sustainable development of the mangrove ecosystem and more importantly help improve the well-being of the community through new opportunities and global networking.



Kenaf Harvesting Machine

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The National Kenaf and Tobacco Board (LKTN) is targeting to have more than 5,000ha of land under kenaf cultivation in line with the National Commodity Policy to make the versatile plant an important contributor to the national economy by 2020. The global demand for natural fibers like kenaf is increasing due to a greater demand for cleaner and greener industrial products. Companies like Toyota, Ford, NEC, and Matsushita, are among the world brands which use Kenaf fibers in their advanced product lines. The world's Kenaf production has increased significantly from 3247.8 tonnes in 2008 to over 32014.4 tonnes in 2013.

Mykenaf Sdn Bhd, Kenaf Natural Fiber Industries and Kenaf Fibre Malaysia Sdn Bhd are among a few companies that lead the development of kenaf in the areas of cultivation, processing and manufacturing. These companies produce kenaf-based fibres, pet food, paper, clothing, building material, car accessories and bio-fuel. Among the potential market prospect for Kenaf stem harvester are Kenaf Fibre Processing Industry, Livestock Feeding Industries, Pulp and Paper

Industries. It can be marketed directly and distributed directly via sales agents and sales representatives.

The kenaf harvesting machine comprises a harvesting system configured to collect the produce and a cutting system located below the gathering system configured to cut the produce at the lower point of the stem with minimum cutting energy. This harvester provides fresh intact raw harvested kenaf stems for the needs of the industry. It is also able to cut more thick fibrous stems at one time (material capacity of 371 t/day for 4 rows) with minimum cutting energy from the lowest point of the stem to obtain more fibers.

It has high field efficiency of 80% and capable of covering field capacity of 4.42 ha/day providing 4-row harvesting in a single pass compared to manual harvesting capacity of 0.01 ha/day. These advantages will make kenaf plantation an attractive alternative to tobacco plantation and offer great opportunity for present tobacco growers to change their crop.



Kenaf Stem Harvester

The “Panel” to Enlightenment

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eBraille aids visually impaired and blind Muslims in their journey of understanding and appreciating the Quran in a more effective, efficient, and convenient way. In under as fast as five minutes, the visually impaired is able to fully navigate eBraille and best of all, teachers are able to wirelessly connect to students' panel to ensure they are in sync with each other.

The team behind this project should receive our respect as the project started as part of their deep-felt social responsibility to the communities while profit remains a distant secondary objective.

Collaborating with various agencies in Malaysia, eBraille sparked the establishment of Braille Al-Quran Learning Centres; two in Kuala Lumpur, one in Penang, one in Sabah, Johor and Terengganu respectively.

The project has managed to garner many awards, with the latest being Best Invention Special Award during ITEX 2016. Indeed, the researchers are committed to keep on improving the system and continuing to innovate for the greater good of mankind.



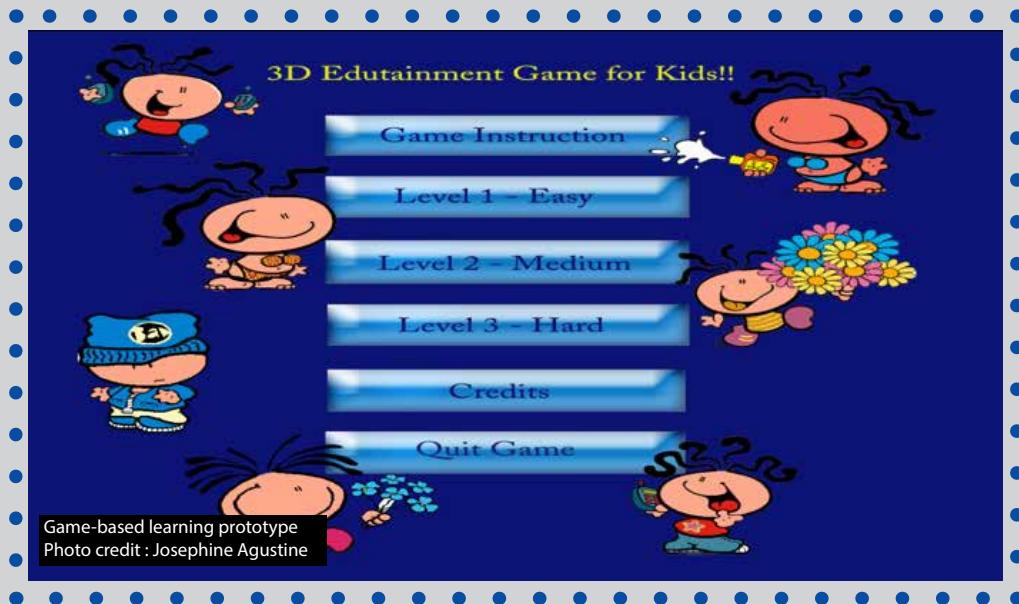
The current generation of eBraille system



Trial and workshop of eBraille

Computer Game-Based Learning: Trends and Opportunities

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Educational computer games can be used to improve learner's understanding alongside traditional books in conveying learning objectives. The pedagogical foundations in educational games though can be effective tools in achieving learning outcome. The computer games can create individual motivation and satisfaction, facilitate a variety learning styles, reinforce skills and provide interactive platform.

A common point of game design could be established for adoption of some of cognitive criteria embedded with a pedagogical approach in order to transfer the knowledge from interactive system to user, and to enable students to understand and build their interest to play the games. Interaction with technology needs a cognitive process, which consists of combination theories, modeling tools, guidance and methods to answer the question how and why people interact with the games.

In order to generate student pedagogy, we need to engage their emotion naturally besides the game mechanics and aesthetics. Their emotion is the second factor that supports affective learning outcomes in educational games. Player's emotion can be detected through their facial expression when playing the games.

It is because, playing educational games can stimulate learner emotion such as happiness, engagement, fun, satisfaction, enjoyment and immersion. Findings from the review show that researchers have to understand the gamer's characteristics of gamers first before designing and developing educational games to map with their emotions.

A good social skill interaction is the action that is represented by learners when they have an effective learning when playing game. Findings from our review so show that it is a challenge in determining the good social behavior such as gender differences. We found and identified the game characteristics that are embedded into learning theory and each of phase of game development are the most important success factors to stimulate learning outcome.



Growing Old Gracefully

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Malaysia is forecasted to be a nation with an ageing population by 2030 when 15% of its population are above 60 years old. Besides burdening the nation with the sheer cost of healthcare, pensions and long-term care, the challenges faced by an ageing population also includes improving the quality of life for the ageing individuals. The USM-RIKEN International Centre for Ageing Science (URICAS) was founded in 2015 as an entity emphasising on interdisciplinary collaboration and internationalisation. RIKEN is Japan's flagship research institute for basic and applied research with a worldwide reputation for scientific excellence. USM and RIKEN are working together to tackle a problem that both nations are already facing as well as problems that we will be facing in the near future.

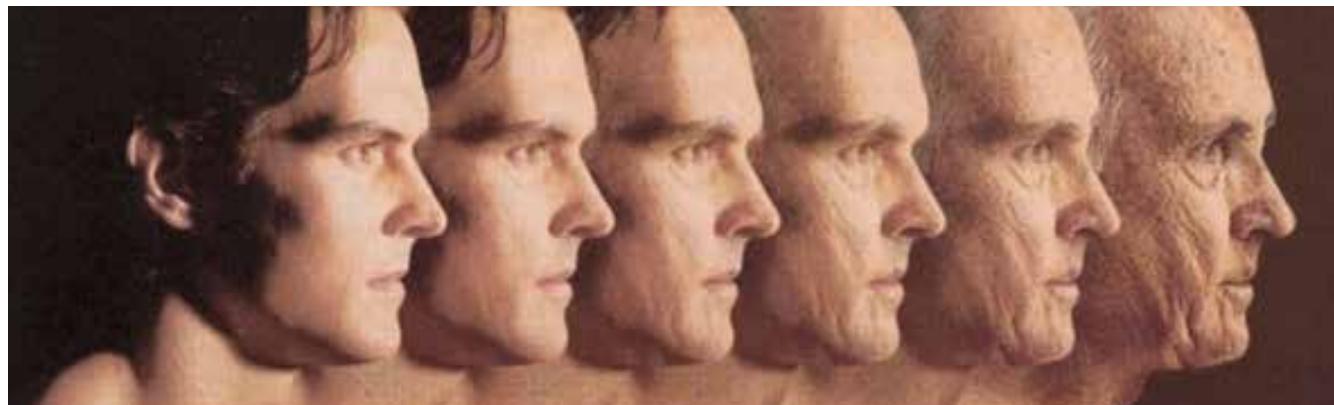
Some of the scientific studies include understanding the roles of selected genes and proteins in the process of ageing using cellular, molecular and structural biological approaches. Screening of local natural products that have potential protective effects on Alzheimer's disease are also being executed using little worms (*Caenorhabditis elegans*) and fruit flies (*Drosophila melanogaster*) as animal models.

URICAS has the following objectives:

- to understand the fundamentals of ageing
- to research and develop innovative healthcare solutions
- to explore the socioeconomic impact caused by an ageing population
- to establish a training centre for talented young researchers in ageing studies

Probiotic microbes as well as small bioactive molecules as hits from a high-throughput screening (HTS) approach are also being studied to identify promising remedies that can slow down ageing or alleviate age-related disorders. Development of new biocompatible materials for aged individuals are also being actively pursued. The role of electron-transfer in DNA with respect to ageing is being studied using muon science and computational methods.

Besides focussing on science, URICAS is also embarking on studying the socioeconomic effects caused by an ageing population. This is in line with our aim of developing URICAS as a transdisciplinary centre with the slogan "AGEING WITH DIGNITY".



Perhaps one of the most awe-inspiring phenomenon in nature is that of bioluminescence. Light from bioluminescence is the product of a biochemical reaction by an enzyme, usually a luciferase, onto a chemical called luciferin. Bioluminescence is not uncommon and can even be found in our gardens. However, when the bioluminescence is displayed by thousands to maybe millions of individual organisms, it becomes a wondrous sight to behold. Along the banks of several Malaysian rivers, such dazzling behavior is displayed by several species of fireflies, which despite its common name, is actually a type of beetle.

These fireflies have an organ aptly named as a lantern organ in their abdomens and it is these that are the visible source of bioluminescent light. There are about 2000 different species of fireflies known throughout the world.

In Malaysia, there are at least fourteen named species. Among the most known species are *Pteroptyx tener*, *P. valida* and *P. malaccae* that inhabit our riverbanks and mangrove forests. The spectacle provided by these fireflies is an important contributor to ecotourism for several rural communities, one of which is Kampung Kuantan, in Kuala Selangor.

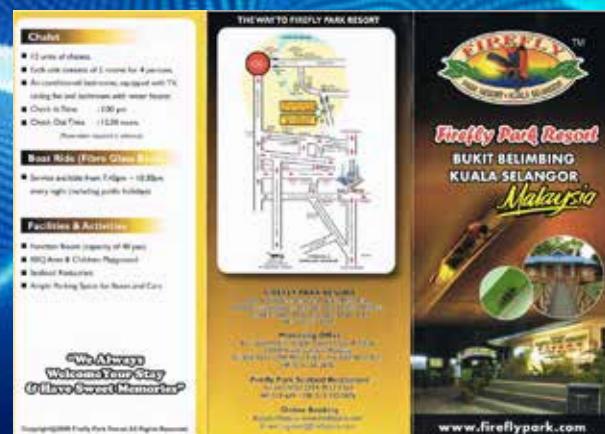
Despite the wonder that the bioluminescence can instill, the fireflies and their flashing have deeper implications. Perhaps better than any electronic

Recombinant luciferase enzyme of Kampung Kuantan firefly produces bioluminescence light in the test tube.



sensor coupled to LED lights, fireflies abundance are a sensitive indicator of a pristine habitat thus they play an important role in projecting the health of the mangrove forests and riverbanks that they inhabit.

As part of efforts to conserve the fireflies and their habitat, a multidisciplinary research group in UKM has been studying these fireflies and their mangrove ecosystem. These efforts are directed towards the conservation of various fireflies species thus indirectly supporting the ecotourism industry. The same group is also undertaking research to study the genomes or the total genetic material of these fireflies. Such investigations are aimed at understanding the underlying mechanisms of the synchronous flashing mechanisms in addition to getting insights of the luciferase mechanism.



How Fireflies are Keeping Rural Ecotourism Alive

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MyECA - Green Technology for Poultry Industry

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The poultry industry is the major contributor to the national livestock industry worth RM10.72 billion or 76% of the country's total livestock industry (RM14.1 billion). However, the industry is not free from issues and challenges such as high production costs and animal feed, disease threats, quality and product safety that can threaten the health of consumers and environmental pollution.

A holistic approach to addressing these issues and challenges is critical and the development of new and effective technologies is indispensable. Through the MyECA green technology, chicken growth is enhanced. Feed consumption is reduced by FCR and chickens are protected from disease outbreaks.

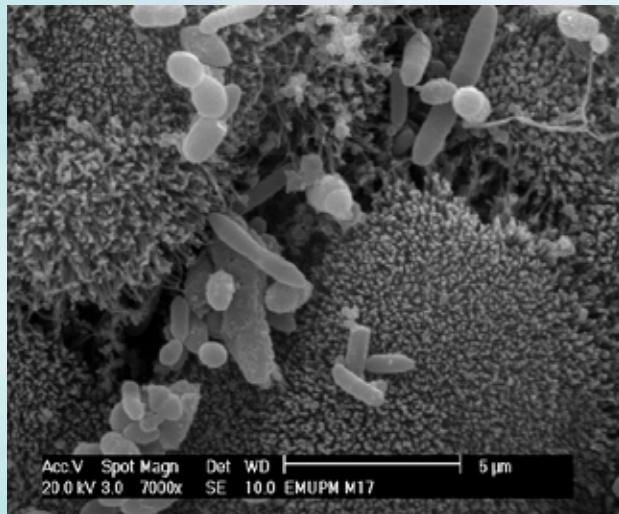
The chicken faeces is of higher quality with the lowest presence of flies. MyECA is able to completely replace the use of toxic chemicals and the reduction of antibiotic use of up to zero and this can lower the risk of the antimicrobial resistance resistance(AMR) pathogens.

MyECA is also capable of destroying microorganisms such as avian influenza virus (H5N1) and velogenic Newcastle disease virus within 60 seconds and very virulent infectious bursa disease virus within 30



minutes. Bacteria such as *Salmonella enteritidis* and *Staphylococcus aureus* can be destroyed as early as 30 seconds after treatment.

MyECA has many similarities with other products such as probiotics and their metabolites, enzymes, phytochemicals and disinfectants. However, the green technology of MyECA has its advantages as it can safely be used as a stimulant for chicken growth and disinfection. MyECA is also 100% eco-friendly and can produce a safe and high quality poultry products. MyECA's green technology will be in the marketplace as soon as the field trials with customers in the industry are completed.



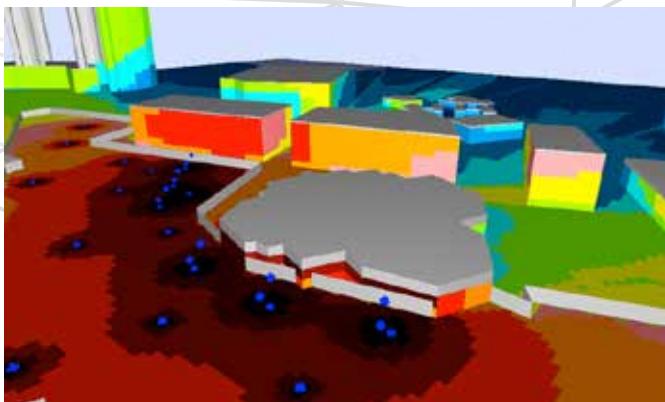
What Noise? Noise?

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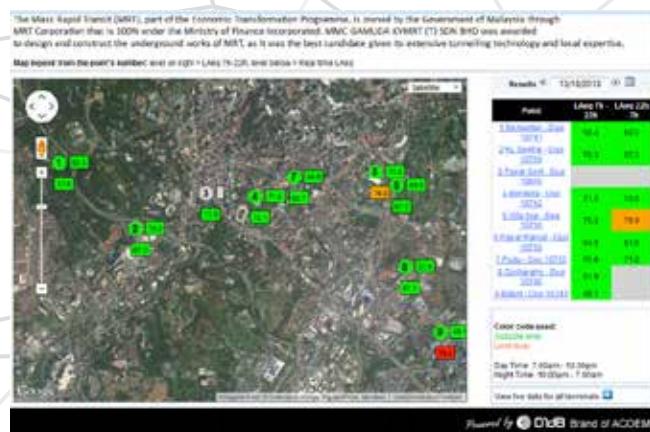
One of high profile projects which many do not realise IKG was part of them was the design of KLIA2's skybridge in which after observation and simulation, the team designed vibration dampers to be implemented on the skybridge to reduce vibration and improve structural integrity. Perhaps IKG's greatest achievement is noise modelling and environment impact assessment of Klang Valley's next generation Mass Rail Transit lines.

No vibration or noise is too small for UTM to handle, thanks to ample expertise in this particular area from the Institute of Noise and Vibration (IKG). IKG is one of the two service-based Higher Institution Centre of Excellence (HICoE) in UTM which specialized in vibration engineering and structural integrity assessment.

It has over 25 years' worth of experience dealing with all kind of engineering problem, completing over 500 projects in total. Combining computer simulation and mitigation techniques, IKG helps companies save millions of ringgit during their operation.



Noise modelling near The National Mosque of the MRT line



Noise monitoring for MRT construction

Low-Dimensional Nanomaterials for Energy, Environment and Sustainable Development

Semiconductors nanomaterials of both inorganic- and organic-compounds have gained significant attention for advanced technological applications, which ranged from energy harvesting up to environmental usages that are crucial for sustainable development. With respect to this, the capability in maneuvering the properties of materials through scrupulous nanoengineering of low dimensional materials indeed has offer a potential route to enable this goal to be realized. In the current UMRG Program (RP007-13AFR) that is funded by the Frontier Science Research Cluster University of Malaya, the integration of three subprograms that endeavors in unravelling the potential application of organic compounds, metal-oxide/sulfide nanostructures and graphene nanomaterials have been merged into a united program to test the feasibility in realizing the aforementioned ideas in optoelectronic devices fabrication, renewable energy application and flexible electronic sensing technology.

Upon commencement of first subprogram, numerous organic-based electronic devices (solar cell and humidity sensor) had been successfully prepared and tested

for its overall performance as well as identification of its weaknesses. For the second subprogram, various inorganic nanostructures synthesis scheme have been developed and the as-synthesized materials have been incorporated into photoelectrochemical cell fabrication in producing hydrogen gas and photocurrent simultaneously. This is well correlated with the worldwide initiative in adopting such technology as a source of clean and renewable energy. For the third subprogram, graphene-based nanostructures have been produced and used as active materials in sensor fabrication. It has been further transformed into flexible electrode that exhibits high selectivity for specific organic compounds and biomolecules detection.

Further efforts are still being devoted in transforming all these research outputs into prototype that exhibit good diversity, excellent stability and cost-efficient, which will eventually leads to the final products that will revolutionize the existing technology for real-life application, specifically targeted for energy, environment and sustainable development.

Spatial Inequalities: Framing Phenomena, Formulating Policies

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Inequality is a notion or measurement of income disparity among individuals in relative to the average income of a nation. Spatial inequality can be defined as the unequal amounts of qualities or resources and services such as medical, welfare and education depending on the area or location. It might be generated by culture, religion, race, or remoteness of the areas.

This situation can be identified by spatial analysis, where Geographic Information System (GIS) can be used to map spatial dimension that describe pattern of inequality. Inequality has often been viewed as lead to poverty. This study that is undertaken in Northern Region of Peninsular Malaysia, comprises of five sub-projects, namely 1) Identifying and Assessing Socio-Spatial Inequalities: A Micro Level Analysis, 2) Bridging Economic Inequality: A Micro Level Sustainable Livelihood Approach, 3) Socio-spatial inequalities – a study on the disabled, never married persons and foreign workers, 4) Spatial Inequality of Ecosystem

Changes and Natural Assets: Challenges towards Sustainable Livelihood and 5) Education as a Sustainable Intervention Strategy: Challenges in Eliminating Socio-Spatial Exclusion and Inequalities for Developing Innovative Knowledge Societies in Malaysia.

In 2015, poverty rate in Malaysia was 0.6% which is considered very small. However, a micro level mapping of poverty indicates that poverty in some sub-districts was much higher than Malaysia's poverty rate. Furthermore, spatial analysis undertaken found that some sub-districts were less accessible to health facilities, public higher education institutions and urban centres.

Furthermore, 1Malaysia Facilities (1Malaysia Store, 1Malaysia Clinics, Rural Transformation Centre) which developed to lessen the burden of low income population seems to be located close to existing urban centre which were less accessible to low income and poor population. Thus, micro level study needs to be undertaken in implementing poverty eradicating strategies to ensure it reaches targeted population.



Skin Cell Spray: Rapid Treatment for Burn Injury

Burn wound is a very common health problem affecting the skin. Burns can be caused by many factors including hot water and oil, electrical shock, fireworks and direct contact to fire. The first-degree burn that involves only the epidermal layer seldom becomes a problem as it can heal naturally. However, second-degree and third-degree burns that affect both epidermal and dermal layers require intensive medical care to reduce mortality and morbidity.

The basic treatment for second-degree and third-degree burns is skin grafting that involves the harvesting of skin from the unaffected area to cover the wounds. Nonetheless, skin grafting may not work for every patient. Thus, alternative treatment such as skin tissue engineering was developed to overcome the problem.

In Tissue Engineering Centre, UKM Medical Centre, many innovative stem cell therapies have been developed for the treatment of

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second-degree and third-degree burns. One of them is Skin Cell Spray for rapid treatment of burn wounds. This therapy involves the spraying of freshly harvested skin cells suspended in platelet-rich plasma enriched culture medium.

This therapy offers many benefits including only a small skin biopsy is needed to treat wound 20 times larger in area, contains melanocytes that help in wound repigmentation, 100% autologous without any components from animal or other human, only requires 3 to 5 hours of preparation and cost effective compared to existing stem cell therapies. The capability of this therapy to promote healing of third-degree wounds has been proven in vitro using 2-D skin model and in vivo using the mice.

In future, in vivo study on a large animal model, prototype development and clinical trial will be performed to prove the safety and efficacy of the therapy before it can be widely used clinically for the treatment of burn patients.



Natural Anti-Inflammatory Bioactives Aids Eczema Sufferers

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Atopic dermatitis (AD) or eczema, an inflammatory skin condition affects up to 20% of children and 5% of adults worldwide. It is characterised by ichthyosis (dry skin), erythema (redness), excoriation (interruption of the skin), scratching lesions, lichenification (thickening of the skin), infected lesions (blisters, pus formation) and hypopigmentation in old lesions.

There is no cure for eczema, but, in most cases, it is manageable and preventable. Clinical management involves therapeutic corticosteroids and calcineurin inhibitors. With the growth of consumer awareness nowadays, the demand for effective nonsteroidal alternatives for eczema managements are at all time high.

Our solution to this is our patented (MY-158177-A) formulation that has bioactives (full spectrum vitamin tocotrienol and tocopherol, carotenes, vitamin C specially engineered to act on troubled skin.

The natural anti inflammatory bioactives obtained from red palm oil is carefully standardized to nano-size range so that they can penetrate to the dermal layer to start acting synergistically to protect and repair the skin. The patented tocotrienol-enriched cream is complemented with other ingredients in a balanced blend to repair despaired skin conditions without involving the use of steroids.

Tocopherol and tocotrienol has been proven clinically to calm itching and burning quickly through their effective anti-oxidant and anti-inflammatory actions. Allantoin and hyaluronic acid in the formulation is able to provide key physiologic lipids and powerful hydration power to return the infected skin areas to its original state.

Preliminary trial data among our volunteers showed that our patented formulation managed to reduce itchiness, flakiness and intensively repaired very dry skin (dermatitis) conditions within just 2 weeks.



Molluscure™ : Toxic-Free Shellfish

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Molluscure™ is a system designed to remove toxic metals from shellfish in accordance to EU Commission Regulation and the Malaysia Food Act. It is backed by a strong fundamental study of Heavy Metals Removal in Green Mussels using Nanobubble Treatment, championed by the same team which developed Molluscure™.

The system is able to remove up to 90% of toxic metal content (compliance with EU and local standards) with only 2 hours of treatment. The prototype development was made possible by the investment from Platcom Venture Sdn Bhd. There is a significant improvement over the conventional method which require 48 hours.

Apart from producing a safe raw food source, the treated mussels are able to fetch RM 3.5 per kg for Malaysia market or RM 30 per kg for international market due to the quality. The system has since been commercialized by our partner, Focus Industrial System Sdn. Bhd.



Launching of Molluscure System in Pontian



The Molluscure System



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Towards a Sustainable Campus - “Zero Waste Campaign” at the University of Malaya

University of Malaya Zero Waste Campaign (UM ZWC) is one of the UM living labs under The Sustainability Science Research Cluster. It was set-up to spearhead development of a sustainable waste management model in UM and ultimately achieve the status of a zero waste campus. Inception of UM ZWC composting project since September 2011 has diverted over 600 tonnes of solid waste from landfill sites.

Separation of waste at source was carried out where the waste streams collected separately are food waste and green waste for composting and anaerobic digestion; used clothes for reuse and recycling; wood waste for energy recovery for a local independent power plant; materials recyclable for re-processing as secondary materials and e-waste for recycling.

Besides environmental benefits, UM ZWC also provides research opportunities, contributes to UM Low Carbon City Framework (LCCF) target and serves as a platform to improve students' soft skill

and entrepreneur skill. Furthermore, UMZ WC has assisted several local communities to develop communal composting project through various collaboration and partnership.

In the next 5-10 years, UM ZWC will play a vital role to formalize collection of recyclable materials in UM and further increase the organic waste recycling, while kitchen waste will be treated anaerobically with AD and aerobically with in-vessel composting.

Collaborations with local and foreign organizations, government agency and private entities will be intensified to introduce environmental-friendly waste sorting, recovery and treatment technologies. Multi-stakeholders participation, support from top management and industrial collaboration are key factors that drive the development of sustainable waste management model in the campus. UM ZWC serves as an institutional sustainable and integrated waste management model and contributes to the national recycling target while bringing benefits to the Mother Earth and society at large.

Sungai Batu Archaeological Complex

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Archaeological research in Sungai Batu Archaeological Complex started since year 2009. The research has revealed Sungai Batu as the earliest civilization in Southeast Asia, dates back to 535 BC, with the discovery of ritual monument, wharf, administration-structure and iron smelting industry. These evidences indicated Kedah Tua Kingdom begun its rule in Sungai Batu since 6th century BC.

With latest archaeological evidences from the iron industry, it showed that Sungai Batu Archaeological Complex was occupied for more than 2500 years by Kedah Tua Kingdom. Sungai Batu was chosen on the first place was due to the geomorphological features around it, such as its close distance to open sea, wide river for boats' accessibility, fresh water for consumption, richness in flora and fauna as well as building materials.

It is known that Kedah Tua Kingdom was a sophisticated kingdom. Iron industry of Kedah Tua kingdom was known to exist since 535 BC with its technology in producing iron ingot for export. Records showed iron ingots produced by Kedah Tua were exported to almost every corner in the world, where it was made into weapons and chariot wheel. Discovery of wharfs, administration centers and a ritual monument further corroborates Kedah Tua Kingdom as a sophisticated civilization.

Research conducted in Sungai Batu for 9 years has contributed significantly in the study of Bujang Valley.



Ritual site



Location of jetty



Iron smelting site



Treating Respiratory Tract Injury Through Cell Secretions

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The inner layer of airway tract, called airway epithelium, plays an important role in defense against pathogens and dust found in the air. Human airway epithelium can be injured due to

- 1) inhalation of toxic agents, particularly toxic fumes or vapors, or microorganisms such as bacteria and viruses in the environment
- 2) accident, surgery or a medical procedure
- 3) disease that causes inflammation of the airways such as chronic obstructive pulmonary disease (COPD) and asthma.

The damage of airway epithelium affects the integrity of the epithelium, thereby enabling fine particles and microorganisms to penetrate airway epithelium tissue. Epithelial wound healing is an important process that involves both expansion and migration of cells to maintain the structural integrity of epithelium. Cells secrete a variety of proteins, including hormones, enzymes and other factors that regulate its own activity and also activity of surrounding cells.

Our lab studies showed that cells of the airway tract, particularly fibroblasts, secrete a variety of protein that can promote attachment, expansion and migration of cells. The wound healing assay showed that airway epithelial cells that are supplied with the secretion of fibroblasts can heal wounds faster. Furthermore, the secretion of fibroblasts was also found to protect cells from the toxic effects of natural medicines.

Thus, the use of the fibroblasts secretion can be an alternative to treat wounds in the nasal cavity and airway tract caused by clinical procedures or pathogenic / toxic substances in the air. This product accelerates the healing of wounds of patients and enable them recover in a much shorter time.

The advantage of this method is

- 1) this secretory product can be obtained in a large quantity from cells of healthy individuals
- 2) have potential as cheaper product but have great efficiency
- 3) there are no side effects in patients

Now, the research is focused on the secretory product use in patients and preservation of the secretory product for long term storage.



Oil Palm Electrical Cutters

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Malaysian Palm Oil Board has developed an efficient motorized cutter which employs a specially designed sickle which is able to perform the cutting more efficiently and faster compared to the conventional cutting tools. Field trials conducted in various estates showed that the productivity of the workers has been found to increase three times as compared to the manual sickle.

The drawbacks of this motorized cutter are the extra weight (due to the gears and shaft) and also limitation in height reach since a longer pole will cause bending to the pole thus causing ineffective transmission motion on the shaft connected to the cutting head. Thus, this existing cutter is only limited to palms below 15 feet of height. It is recognized that this 'rapid chopping method' has great potential and therefore the demand to develop a longer reach (at least 12m) is necessary to solve the harvesting problem that the industry has been facing for years.

Malaysian Palm Oil Board in collaboration with Universiti Putra Malaysia has developed a motorized cutter is able to perform the cutting smoothly, efficiently and faster compared to the conventional cutting tools. Field trials conducted in various estates showed that the

productivity of the workers has been found to increase by a factor of three compared to the manual method of harvesting. The problems of this motorized cutter are the extra weight and also limitation in height reach since a longer pole will cause bending thus, resulting to ineffective transmission shaft and motion to the cutting head.

This project had involved several grants from MPOB and UPM and was ended in 2012. The laboratory prototype had undergone experimental and field tests trial. The performance results show that it can cut a palm oil fruit in 3 second which is very fast and more efficient than the manual method by a factor of 3. As a result, an electrical cutter that can perform oil palm harvesting for unlimited reach of height had been presented from this previous research.

However, certain improvement is required based on the previous prototype so that it can be accepted and used for oil palm settlers commercially. A feasibility study of an oil palm electrical cutter is required which consists of up-scaling and field testing. For these reasons, several large scale prototypes of an electrical cutter that has 30 foot of length are required to be developed and field tested locally in various oil palm plantations in Malaysia.



Low Carbon Society

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UTM-Low Carbon Asia (LCA) gathers a group of researchers in UTM in a forefront bearer of innovative science and technology solutions to the promotion of sustainable urban future in Asian cities. Over the year, LCA has received numerous research grant from the Japanese counterparts, especially Japanese International Cooperation Agency (JICA).

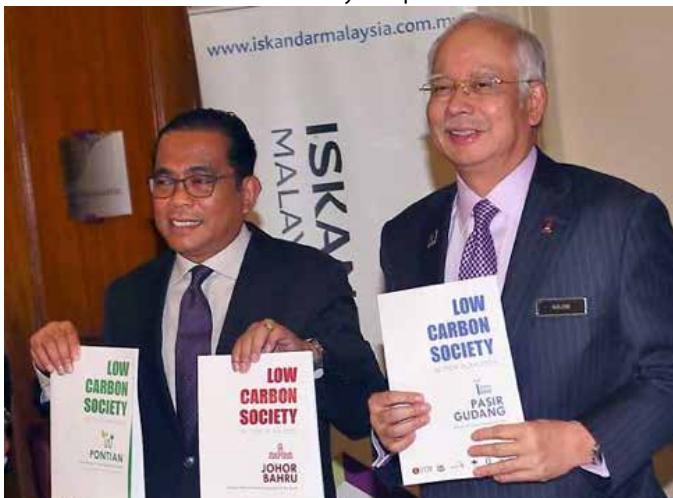
One particular highlight is the Development of Low Carbon Society Scenarios for Asian Regions project, sponsored by JICA through Science and Technology Research Partnership for Sustainable Development. The strategic partnership bring together the best experts from Japan and local region for building the capacity for the research topic, in this case, Low Carbon Society. The project was timely during 2010 in which Iskandar

Malaysia is under rapid development. The collaboration has enabled Iskandar Malaysia to incorporate sustainable development besides ensuring economic growth in the region.

The outcome outlined include pedestrian friendly neighbourhood, efficient yet eco-friendly public transportation and low carbon lifestyle, with the ultimate aim of limiting the CO₂ emission to 1.5 times in 2025 as compared to 2005, instead if four-fold without such counter-measures. A number of policies and guidelines were spun-off from this partnership including Low Carbon City 2025: Sustainable Iskandar Malaysia and Low Carbon Society Blueprint for Iskandar Malaysia 2025.

Low Carbon Society Blueprint for Iskandar Malaysia

Low Carbon Society Blueprint for All Districts in Johor



Summary for Policymakers
**LOW CARBON SOCIETY
BLUEPRINT** Third Edition
FOR ISKANDAR MALAYSIA 2025
WITH 10 IMPLEMENTATION PLANS



Benefits of Cultivating and Consuming Mushrooms

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Mushrooms are palatably delicious source of proteins, vitamins, and minerals whilst having low in fat content. Mushrooms provide tremendous health benefits, including having anticancer and immune boosting properties. They also have the potential to reduce cholesterol and minimise the risk of heart diseases. With alternative medicine becoming more widely accepted, opportunities for health and dietary supplements has continue to increase. The demand for mushrooms in Malaysia is projected to increase in tandem with the increase in population and consumption per capita owing to their concerns towards health and other medicinal benefits.

Mushroom production in Malaysia that has started way back in the 1960s is still insufficient to meet the economic demands mainly due to the lack of scientific support from academic institutions. Most growers in Malaysia cultivate mainly the *Pleurotus* spp. (oyster mushroom) since growing other species pose higher risks. Therefore, to increase variety in the market, our research focuses on optimizing cultivation of mushrooms such as *Schizophyllum commune* (Cendawan Kukur/Sisir), *Auricularia polytricha* (Jelly mushroom) and *Hericium*

erinaceus (Monkey Head Mushroom). Specialized treatments for each species to produce consistent yields of high-quality, marketable mushrooms have been determined. In addition, good quality mushroom culture obtained by selection, hybridization and mutation to produce spawn were done. Strains that have incorporated local germplasm are more adaptive to local growing conditions generating more predictable and reliable results. Good quality mycelium spawn has been developed and patented (PI 2010700017).

Now rural communities can increase their income by cultivating mushrooms as our research produced high-yielding inoculated mushroom bags that require only a mushroom house. With this cooperativity between local cultivating and marketing industry along with research, marked improvements have been seen in quantities and variety of mushrooms availability, particularly for the wholesale market, processed and mushroom-based foods and even nutraceutical/functional foods. With this strategy, we can increase the production of mushrooms to reduce the imports and balance the trade for Malaysia which imported more than USD 4.66 millions of mushrooms in 2012.



Archaeology Exploration in Eastern Sabah

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On August 28, 2015, stone artifacts were found in Balung, Tawau Sabah, in the East of Sabah. They were located near the main road between Tawau and Semporna. It was discovered by Dr Velat Bujeng from the Global Archaeological Research Centre (PPAG) in collaboration with the Archaeology Division, Sabah Museum Department. Based on these findings, this site is likely to be a Palaeolithic open site. This area was once interpreted as an early human migration route using the GIS method by Dr Jeffrey Abdullah in 2007 while conducting studies in the Mansuli Valley.

So far, only two open Palaeolithic sites have been studied and dated. The open sites are the Mansuli Open Site aged 235,000 to 15,000 years ago and Tingkayu Open Site aged 12,000 years ago. Therefore, the discovery of a new site is important to prove the eastern part of Sabah is the main route of early human beings.

During the Pleistocene epoch, Borneo was a part of the Sundaland which influenced by sea level changes. It is surrounded by the oldest Palaeolithic sites in Southeast Asia, Lenggong, Perak, Malaysia (1.8 million years - Early Pleistocene), Java (1.7 million years ago - Early Pleistocene) in Indonesia and Cagayan Valley, Luzon in the Philippines (Middle Pleistocene).

Therefore, the discovery and study of the Palaeolithic open site in Sabah, especially in the east of Sabah, is important to find the connection between Palaeolithic open sites in Southeast Asia. The main relation that can be seen is an early human migration during the existence of Sundaland. In fact, this study also contributes some data with age, lithic technology and old environment to archaeological data of Sabah and Southeast Asia. Furthermore, information about cultural sites is important for any plans to develop the archaeological sites as places for archaeotourism.



The surface find of stone artifacts on the open site of Balung, Tawau, Sabah.



The location of the site is close to the main road.



Traffic Accidents and Statistics : More Than a Number

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With more vehicles on the roads, traffic accidents are on the rise. They are emotionally, physically, and financially draining. Hence, it is essential to understand the cause of accident scenarios.

Traffic engineers are the pioneers in this type of research since they want to understand road conditions and geometry in order to plan and develop safer roads that can reduce the risk of traffic accidents. Based on recorded data and past experience, the implementation of statistical approaches can help to achieve this aim.

Traffic accidents can be classified into a number of categories such as head-on or rear-end accidents. Commonly, traffic accidents with different categories are modeled individually. Another path in statistical knowledge allows the modeling of multivariate data, hence different categories of traffic accidents can be modeled simultaneously. Through this approach, the dependency (correlation structure) in the data can be utilized in order to obtain more information and produce a better prediction.

The dependency between an accident with another can be contributed by these factors:

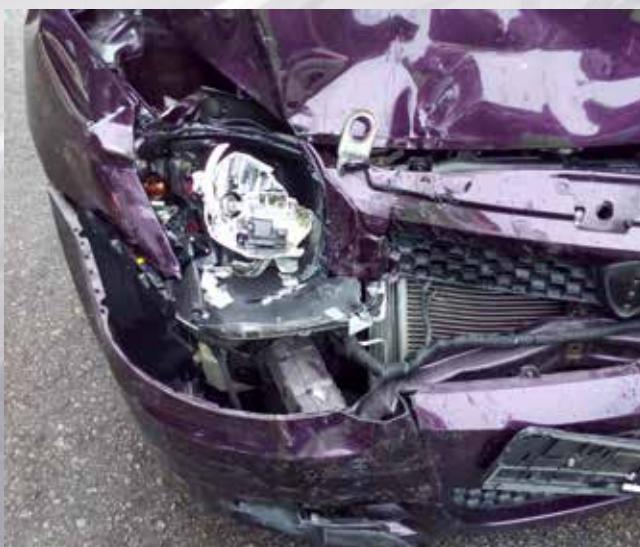
- spatial – there is a relationship between accident occurred at intersection A and the accident occurred at intersection B

- temporal – there is a relationship between accident occurred at the peak hour today with the accident occurred at the same hour yesterday
- accident category – there is a relationship between the head-on and rear-end accident

Information from these relationships can be inserted as an element in developing a statistical model with improved estimates on the number of accidents.

This process is analogous to baking a cake. A very basic cake can be made if we have the eggs, sugar and flour. If we want a cake which tastes better, or beautifully decorated, more materials such as cherries, cheese or cocoa powder are needed. Hence, a statistical model basically can be developed through the observed accident data and related factors: traffic flow, road geometry or weather. However, since not all factors can be observed, incorporating the spatial, temporal or categorical dependency elements can improve the model.

Overall, the role of statistical models is very relevant in understanding the occurrence of traffic accidents. With the advent of technology and a more detailed recording system, it is an ongoing process on improving the existing models from time to time. The improvement is very essential for predicting and understanding the occurrence of traffic accidents, in benefit for the society and nation.



Solving Energy Crisis

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Why do we need to promote hydrogen energy? The scientist lays out about four main reasons-energy-saving, minimal ecological impacts, energy security and industrial competitiveness. Instead, industries generally use a fossil-fuel based process to produce hydrogen for fuel cells, which generates harmful greenhouse gas emissions.¹ The cleanest way to produce hydrogen is by using sunlight to directly split water into hydrogen and oxygen. By developing an optimal photocatalyst, scientists are searching for the ways of improving the production of H₂ and O₂ from water without producing greenhouse gases or having many adverse effects on the atmosphere.

Since the complex production process of photocatalysts and high cost of precious metal cocatalyst remains a major hurdle to producing hydrogen from water, a noble metal free photocatalyst synthesized via a facile one-pot solid phase reaction is realized for the first time for efficient visible-light-driven H₂ evolution. The catalyst demonstrate its impressive performance for photocatalytic hydrogen production rates of upto 3200 μmol h⁻¹ under visible light irradiation without any supporting electrolytes, buffering reagents, pH adjustment, or applied voltage.

Such extraordinary performance of a noble-metal-free photocatalytic hydrogen production from water has, to our knowledge, not been reported to date. The results demonstrate an important step forward one-pot facile approach to prepare photocatalysts from waste for

efficient visible light–driven H₂ production. The good catalytic performance was resulted from its good absorption ability of visible light, highly effective separation of photo-generated electron-hole pairs during the photocatalytic water splitting process.



Bubbles of Hydrogen Formed During the Chemical Process of Catalysis

Halal Consortium



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Halal Consortium is a collaboration effort between Universiti Teknologi Malaysia and Iskandar Regional Development Authority (IRDA) to develop Halal capacity in the region. One of the success story so far the the development & implementation of Halal Smart Auditing System.

UTM, through its spin-off company, Halal Informatics (HOLISTICS) Lab Sdn Bhd, bring its 8-year experience of research and development of various technology for halal industry. Among them are the QuikHalal™, a cloud-based mobile halal auditing apps, Hacademy™, an online halal education platform and others.

The smart and quick halal certification platform addressed the fact that only 1% of Small & Medium Entreprise (SME). Compared with conventional means of halal auditing, QuikHalal™ enables cost-saving of 20% to 30%, while enabling modular, plug-and-play certification specifications to cater different region.

QuikHalal™ was launched during the Halal Certification Bodies Convention 2017 and has garned interest from various bodies in the world. Due to the different standard set by the respective bodies, the modular nature of QuikHalal™ enable a more global outreach to more than 200 Halal Certification Bodies.

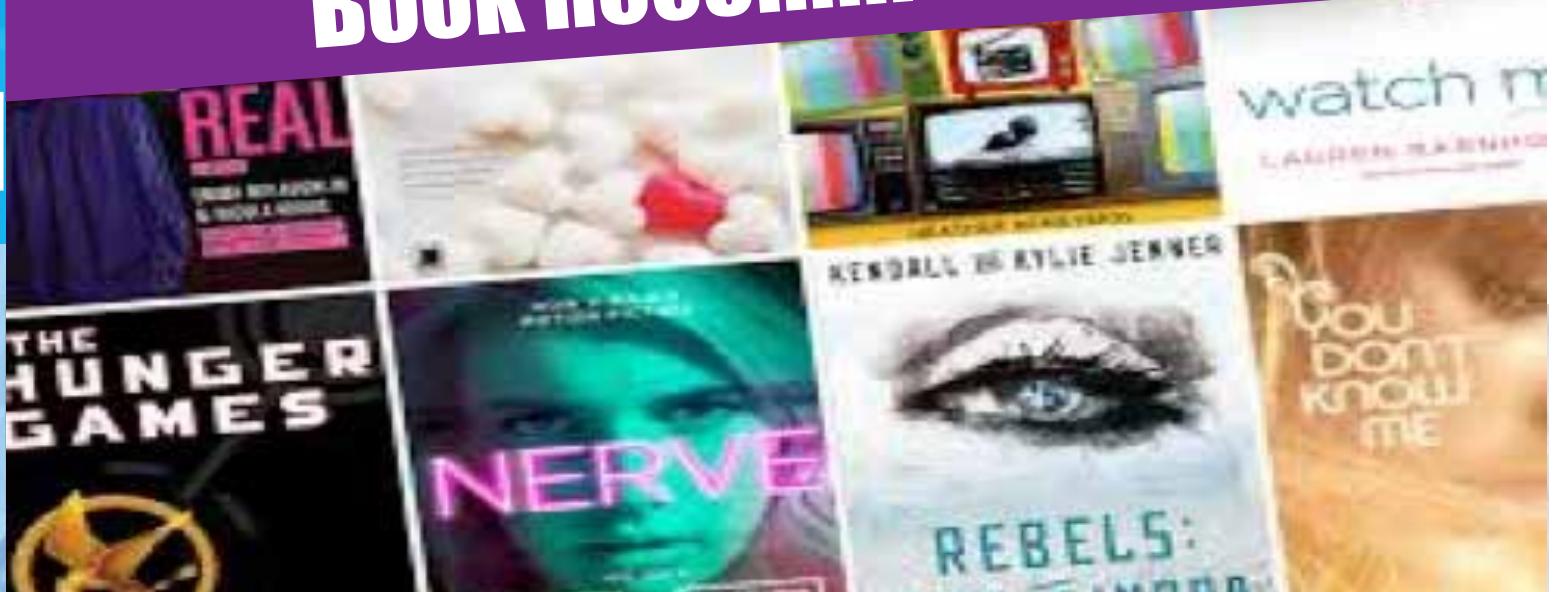


UTM, represented by Dr Iskandar, at the Halal Certification Bodies Convention 2017



QuikHalal™

PHyBR : Personalized Hybrid Book Recommender



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Personalized recommender systems (RSs) aim to assist potential customers in identifying appropriate products and services based on specific characteristics of the users, such as gender, age and emotion. Drawing inspiration from this trend, a Personalized Hybrid Book Recommender (PHyBR) was developed to improve book recommendation relevance by incorporating several filtering mechanisms.

PHyBR is unique in the sense that it takes several key contextual-features into consideration, namely, users' demographic details (i.e. age and gender), personality traits, geographical location, purchase motivations (i.e. reasons provided by previous buyers) and interestingly, the sentiment of user reviews.

When a user, say User A (male and between 20 – 40 years old) with Extraversion personality finds a relevant book and rates it with a 5-star, his recommendation list will

portray the book first, followed by other relevant books that are matched based on the contextual-features.

When User B with the same personality, age and location logs into PHyBR, the book rated highly by User A will be presented first, considering that they share similar features. Assume User B searches for "War" and rates "The Strange Death of World War II" as 5 stars.

His recommendation list will now feature this book to be highly relevant. PHyBR was tested in two user trial environment, namely in Klang Valley and Malacca with results indicating PHyBR to outperform the baseline RSs (i.e. with only personality or demographic details), suggesting that when users' contextual-features are integrated, the recommendation relevance are improved.

PHyBR is also scalable in the sense that it can be used to recommend other products such as movies and music.

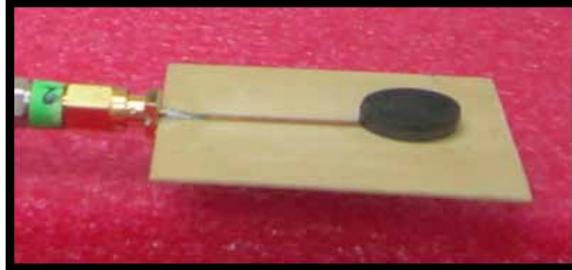
Electroceramic for Microwave Applications

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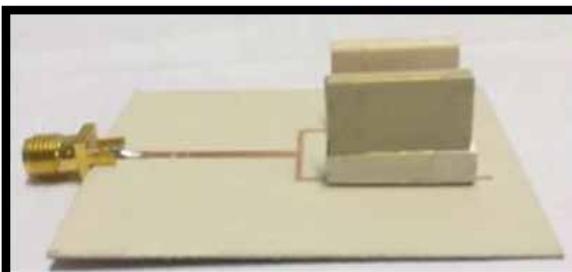
The rapid development of wireless system technology requires antenna technology capable of offsetting the size of the associated equipment. Therefore, research in antenna technology needs to be implemented to find appropriate antenna techniques and designs that can complement the rapid development of wireless technology.

In response to the challenge, disciplinary research between the School of Electrical and Electronic Engineering and the School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia conducted to find new potential antenna materials for the current wireless system. As a result of this collaboration, dielectric resonator antennas have shown a great potential through research work carried out from various aspects of theoretical and numerical analysis, excitation techniques, compact designs, polarization controls, wideband operations and array implementation in order to achieve high gain performance.

Dielectric resonator antenna is a commonly low gain antenna with a broad radiation pattern. As with other conventional low gain antennas, dielectric resonator antennas can be arrayed to acquire higher gain. As a result of the study, it is clear that the dielectric resonator antenna has good efficiency and flexibility that cannot be found in other types of antennas. The dielectric resonator antenna technology has been used effectively for wireless communication systems and it is able to make a huge impact on future communication systems.



Cylindrical Dielectric Resonator Antenna



Rectangular Array Dielectric Resonator Antenna

Recycling Slaughterhouse Waste into Valuable Biomaterial



Collagen is the most abundant proteins in the mammals including human, and it comprises 25-30% of total protein content. Due to its availability in human tissues such as skin, bone, tendon, ligament, collagen has high demand in the biomedical and cosmetic industries for public needs.

To meet the demand, extensive research has been conducted worldwide to recycle slaughterhouse wastes such as skin, bone, tendon, from husbandry animal to extract collagen for human uses. Collagen can be used to form different frameworks such as film, sponge, hydrogel, and nanofibers, which mimics the architecture of native human tissues. Moreover, collagen from animal sources was shown to improve growth of human cells. Thus, it is considered as a potential material to produce engineered tissue substitutes to repair or regenerate damaged and diseased tissue.

At the Tissue Engineering Centre, UKM Medical Centre, collagen was extracted from sheep tendon, considering its acceptance for all cultures and religions compared to the cow and porcine. The sheep collagen was used to fabricate different frameworks such as thin film, sponge, and hydrogel, and validate their applications in forming engineered skin substitutes and delivery of growth factors in the animal model.

The findings of this study showed the high impact to the public and industry regarding the improvement of recovery in skin injuries. However, the applications of sheep collagen are not limited to the regeneration of the skin, but it can be utilized for other tissue substitutes. In addition, this innovation contributes to economic generation by reusing husbandry waste for health products.

The Future of Palm Oil Extraction

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A review of the processing methods adopted by the oil palm milling industry has revealed that mechanical palm oil extraction methods (the industry preferred method) have not changed since the pioneering continuous extraction initiatives by United Plantation's Tan Sri Bek-Nielsen and Axel Lindquist.

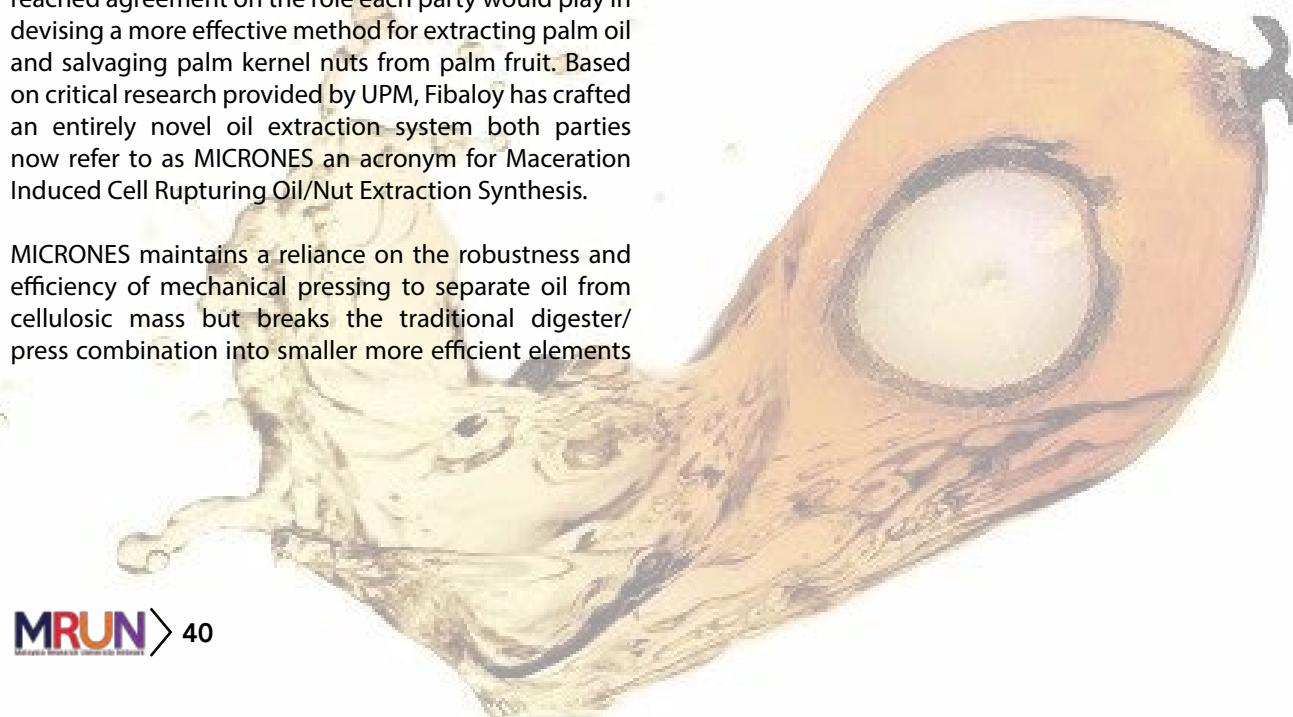
Almost 60 years later in January 2016, Fibaloy and UPM reached agreement on the role each party would play in devising a more effective method for extracting palm oil and salvaging palm kernel nuts from palm fruit. Based on critical research provided by UPM, Fibaloy has crafted an entirely novel oil extraction system both parties now refer to as MICRONES an acronym for Maceration Induced Cell Rupturing Oil/Nut Extraction Synthesis.

MICRONES maintains a reliance on the robustness and efficiency of mechanical pressing to separate oil from cellulosic mass but breaks the traditional digester/press combination into smaller more efficient elements

and incorporates control automation to synthesise functionality as an integrated system.

Unlike traditional digestion, MICRONES technology efficiently induces pericarp maceration by subjecting the fruit to thousands of lacerations as it passes through the chamber instead of relying on the inefficient friction forces created by the rotating impeller blades which characterise the traditional digester to rupture cells.

MICRONES is a creative and effective solution for recovering CPO and PK losses caused by the traditional mechanical method. Accepting kernel loss and CPO loss at the point of oil extraction as an inherent tolerable processing loss is causing the unnecessary depletion of natural resources and depriving the Malaysian oil palm industry and the economy of valuable export revenue. While a 0.5 percent CPO loss and a 0.5 percent PK loss due to extraction may seem only a small fraction of the extracted oil, it has a devastating financial, social and environmental impact on the overall sustainability of the supply chain.



Johor Strategic Innovation Institute

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The Johor Strategic Innovation Institute (IISJ) is another brainchild of UTM. Realizing the huge potential, and most importantly, how the local communities are going to gain from, the Johor State Government has proudly embraced the institute to become part of the Johor State agenda.

It was launched on 21 Mac 2016 by the Chief Minister of Johor. With matching grants from multiple parties, the first phase of Low-Hanging Fruits Projects, has been making waves in the local news. Some of the highlights include the Muar Digital Gateway (tourism application), Aquaponics Project in Kota Tinggi and Sustainable Awareness Program in Kulai.

These projects might look ordinary community projects to the outsiders but actually they are very much backed by the results obtained from our research as part of our promise to engage in research that matters.

The execution of the projects was inspired by the concept of Community Based Participatory Research, aligned with the four cores of the National Blue Ocean Strategy (NBOS); Low Cost, High Impact, Rapid Execution and Sustainability. Apart from that, IISJ also hold a yearly, state-level innovation showcase/awareness program that gathers together researchers from all over Johor to participate in product exhibition, business matching session and student innovation challenge.

In short, IISJ act as a collaboration platform that provides and encourages technology-based innovation among communities, modeled after the famous Silicon Valley.



Muar Digital Gateway, a Mobile Application to Empower Tourism in Muar



Changing the Community Behavior of Waste Separation via Gamification



Vermicompost:

Improving Soil Fertility and Quality of Sabah Snake Grass Plant

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The agricultural industry is an emerging industry in Malaysia. Numerous agriculture activities have resulted with vast amount of organic wastes production from yard trimmings, animal manures, spent mushroom to food residuals. Therefore, any potential approach in converting these organic waste into valuable nutrient-rich materials is crucial and need to be explored.

A three-year pilot research conducted at Pusat Penyelidikan Bioteknologi Glami Lemi (PPBGL) UM, Negeri Sembilan proved a successful lab to large scale vermicomposting of saw dust from mushroom cultivation and goat manure mixture. Vermicomposting is a process of converting organic matter into high value of organic fertilizer with the assistance of selected earthworm species.

For this study, a herbal plant known as Sabah Snake Grass has been used as indicator plant to study the effect of the application of this vermicompost fertilizer compared to normal chemical fertilizer. An appropriate rate of both fertilizers were applied to Sabah Snake Grass plant to see its growth trend, post-harvest effect and their impact on soil fertility without polluting the environment, due to its organic nature.

Sabah Snake Grass was chosen for this study due to its medically related nutrient content. Sabah Snake Grass contains various amount of nutrient elements that might be beneficial for human consumption. Sustenance of the nutrient composition of Sabah Snake Grass by treating it with organic fertilizer (vermicompost) instead of using chemical fertilizer is important.

Vermicompost application shows a significant increase on the growth rate of the Sabah Snake Grass compared to the ones treated with chemical fertilizers. Further studies are being conducted to determine the effect of the use of vermicompost on the nutritional composition and antioxidant levels in Sabah Snake Grass.



Raw materials : spent mushroom compost from PPBGL Jelebu



Final vermicompost product from spent mushroom compost and goat manure

Pilot scale preparation on site at PPBGL, Jelebu



Sustainable Archaeology Tourism in Lenggong Valley

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Lenggong Valley is located in the northern state of Perak, and was recognised as a World Heritage Site (WHS) in 2012, making it the fourth WHS in Malaysia. This grant has been awarded to a group of USM researchers from Sustainable Tourism Research Cluster (STRC) to support the implementation of community project awarded to the similar group by the Northern Corridor Implementation Agency (NCIA).

In an effort to develop community based tourism entrepreneurship in the Lenggong Valley World Heritage Site (LVWHS), NCIA has provided a certain budget for training and buying equipment; meanwhile the budget for the programme management has been covered by the Research University grant. The programme began on January 9, 2017 where two villages have been selected, i.e. Kampung Raban and Kampung Luat.

Each kampung community has been trained for two product developments. For the Kampung Raban, the focused products for men include the T-shirt printings,

mugs, tiles and plates while the women prefer to produce tudung saji and small mengkuang-woven handicrafts. As for Kampung Luat, the women produce two traditional food known as kebebe and ikan pindang while the men make wood handicrafts such as sarung golok and keychain.

The 2-year project includes training on entrepreneurship, product development, financing, marketing and business sustainability. In the period of 2 years, USM needs to ensure that the community is adequately capable to run and grow their businesses. This programme stimulates the development of tourism industry in the LVWHS and the sustainability of the programme is important to ensure the youth will remain within the vicinity and play their roles in the development and conservation of the heritage site.



A Syndemic Approach to Public Health

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Transferring fundamental knowledge to students in understanding the management of health issues is not ensuring students' ability to meet the need of national aspirations. The country needs competent human capital which commensurates with the requirements of tasks and challenges.

Learning in the classroom cannot instill the spirit of managing real public health issues. Reading or paperwork assignment is insufficient in giving students exposure to meet the challenges in the management of complex public health issues. Syndemic approach has recently been highlighted in curbing health problems. It is intended to combine the various determining factors / variables of different aspects by the involvement of multiple agencies at multiple levels.

The blue ocean strategy is being used at the ministerial level in an effort to combine the activities of various parties in shaping the transformation of program activities. The World Health Organization has produced the framework in addressing social determinants of health. However, the concept will not be effective if it is not practiced.

The latest public health issue which had been questioned in the media and debated last year in Malaysia was the rejection of vaccination of children. This problem has been used as a trigger for students of Public Health Doctor Program. Students are required to identify health problems priority in fieldwork and its root causes. The results showed that the ineffective communication in delivering accurate information to the customers and

the strong influence of social media were noted as the root problems. The syndemic approach was applied to solve the problem. Exploring problems faced by the vaccine refusal and disseminating accurate information in a systematic way using syndemic approach was highlighted.

This technique has been benefited to the health providers at district level. A total of 65 health providers consisting of doctors and nurses have been echo-training by the trained students using syndemic approach. The impact of this approach can be measured by increasing self-efficacy score in the health providers in dealing with people who refuse vaccinations for children.



Easy Travelling

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In 2013, the online travel sales were reported at USD590 billion, accounted for nearly 26% of the global travel and tourism sales. Malaysians display greater propensity (51% as compared to the global average of 26%) to use internet including social media to get ideas and inspiration for travel destinations. They also use the online platforms to help them to search for activities (44%), attractions (44%), accommodation (39%) and restaurants (36%).

Smart Travel Packages Recommendation System is a web based system for recommending travel packages based on traveler's preferences. It allows the user to conduct a comprehensive research by utilizing searching and recommendation of travel packages based on the preferences and need of users. The system utilizes the preference evaluation techniques (Top-K, Skyline, Top-K dominating, K-Dominance, K-frequency).

It can be used as a tool to promote travel agencies as one stop center for travel packages. It is also saves time effort in searching travel packages. The searching method of this technology by combination of keywords and user preferences as compared to Google and Expedia which only use keyword based searching method.

The system has several benefits to travellers allowing them to meet their travel preferences, saving them time and effort in searching travel packages by customising the list of recommendations for them to choose from. It also benefits travel agencies by making it easy to advertise travel packages thus lowering the cost of advertising as well as expanding market reach.

Environmental Performance Index

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The Malaysia EPI was developed by UTM with financial support from the Ministry of Natural Resources and Environment (NRE) in 2012. Malaysia EPI aims to provide policy makers and the general public data driven information system that is a useful decision making tool much needed towards achieving Sustainable Development Goals (SDGs) and the New Economic Model (NEM). It was inspired by the global EPI efforts by Yale University and Columbia University (www.epi.yale.edu).

The main difference, however, is the Malaysia EPI uses different sets of data, different sets of indicators which resulted in different framework altogether. With such detailed benchmarking, Malaysia EPI seeks to provide an insight into the existing



UTM's EPI Team Sharing Session with their Vietnamese Counterparts.

environmental data and information, hence better understanding on the environmental challenges faced at local, national and global levels.

In general, it offers decision makers and implementers as well as the public access to important environmental data organized in a way that is easily understood, useful, and further drives the motivation for improvement.

The team comprised of multidisciplinary experts from various faculties across UTM which is engaged constantly with various government agency stakeholders who are custodians of the dataset. The team has been appointed as consultants to the Vietnamese government for their country-level EPI, another example of UTM's research that goes beyond the campus and the country.

Malaysia Environmental Performance Index Framework



Empowering Men To Screen: The ScreenMen mHealth Project

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Despite being perceived to be the 'stronger sex', global men's health reports found that men have shorter life expectancy and higher morbidity and mortality across most illnesses compared to women. Various efforts have been made to address this; health screening is recognised to be an effective strategy to improve men's health. However, the uptake of screening in men is low; this has motivated the University of Malaya Men's Health Research team to find solutions to tackle this important public health problem.

As Malaysia has high mobile phone ownership, we explored the use of mobile technology to modify men's health-screening behaviour. Mobile health (mHealth), which aims to deliver healthcare to people anytime and anywhere, is becoming an important strategy to improve health care globally. It provides a convenient platform for men to seek health information, particularly among busy working adult men who are hard to reach.

Using the UKMRC Framework, the ScreenMen mHealth project team collaborates with CIMB Group to develop a mobile web app to increase uptake of health screening among male workers in the bank. The content is produced based on recommendations from local and international clinical practice guidelines on screening and a user-centred approach is used to design the web app.

The rigorous content development and iterative designing process makes ScreenMen the first mobile web app in the world to provide comprehensive and evidence-based health screening for men. It contains a bite-size educational video that addresses misconceptions about health screening, an in-built algorithm that guides men systematically through the screening process and provides personalised health screening recommendations based on individual health risks. ScreenMen empowers men to undergo evidence-based health screening, and educate them to avoid unnecessary health screening tests such as tumour markers and imaging.

ScreenMen was pilot tested and found to be useful in motivating men to go for screening. For more information, visit: <http://ehealth.dicc.um.edu.my/area-of-expertise/the-scremen-project/>

Innovative Medical and Therapeutic Applications in Aged Patients

Advanced age results in various complications during surgery and interventional therapy. The main causes of which can be attributed to the slow healing process in aged patients and the choice of biomaterials used. Stiff synthetic patches are unable to adequately heal repaired tissues.

Only a limited number of synthetic biomaterials are currently available in the market. Therefore, there is a need to develop biomaterials that have a wide range of properties and functions suitable for aged patients and slow healing interventional treatments.

Biopolymers, polymers originated from biological sources, are usually divided into four types, namely, nucleotide, protein, polysaccharide and polyhydroxyalkanoate (PHA). Biopolymers of natural origin have been investigated for the preparation and application of biomaterials for a range of applications, including scaffolds in tissue engineering, because of their biocompatibility, cellular adhesive features and biodegradability.



We have carried out a study on synthesis and material design of PHA and structural proteins for wide variety of biomedical applications. PHA which is a biodegradable and biocompatible polyester, shows plasticity and can be fabricated via general thermal process.

Silks are biodegradable, biocompatible, self-assembling proteins that can also be tailored via genetic engineering to contain specific chemical features, offering utility for drug and gene delivery. Silkworm silk has been used in biomedical sutures for decades and has recently achieved Food and Drug Administration approval for expanded biomaterials device utility. We plan to develop suitable biomaterials based on PHA and silk polymers, which will contribute to the wellbeing of aging society.

Homes for Active Ageing

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Malaysia is one of countries that is undergoing rapid development phase and will be an ageing nation by 2035 with the elderly group making up 15% of the total population. Changes in fertility and mortality levels have affected the age structure of the elderly population. Compared to other developed countries, Malaysia has a rather short time to prepare itself for the transition into an aged nation due to the fast rate of growth of the elderly population.

Retirement village (religion based).

"Pondok" can be referred to the traditional Islamic educational institution. Usually, the "pondok" is developed to become a place for the elderly to seek religious education and a new settlement that fulfills their needs for a harmonious, sociable and mutually supportive environment. Currently, the "pondok" system is becoming more popular among the elderly in Malaysia and is seen to be a new concept of living that provides in-house religious education as their core activity. The "pondok" system has a similar concept with the retirement village as practiced in few developed countries such as Korea and Australia.

The Layout plan of existing buildings and amenities of Pondok MAAB

Photo credit : Sketch by Profesor Madya Dr Sr Noor Rosly Hanif



The Phase 2, part of the Pondok MAAB residential units

Photo credit : Profesor Madya Dr Sr Noor Rosly Hanif

Designs and facilities that fulfill the living conditions of elderly.

Previous studies stated that, unlike the retirement village that focuses on accommodation, housing and facilities; the "pondok" system does not have a clear guideline to accommodate the wellbeing of the living condition for the elderly. This study aims to improve and propose a special guideline in order to provide a sustainable living for the elderly who lives in retirement village with religion-based "pondok" concept.

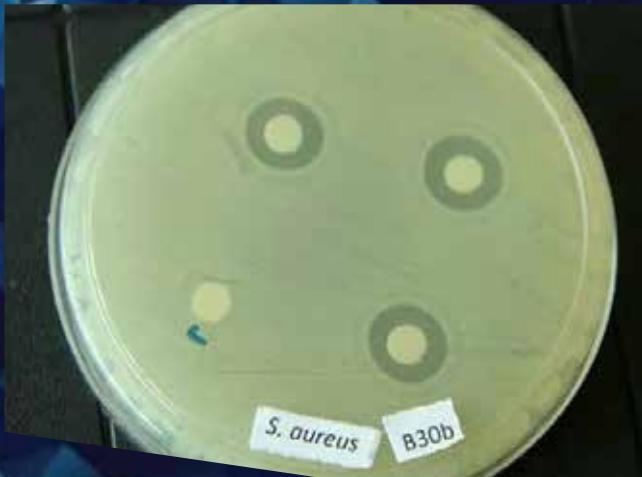
Personal interviews and focus group discussion with the residents of Pondok Moden-Baitul Maab to obtain information on what could be improved so that it is suitable for elderly living. The residents survey indicated that the existing design and facilities are not ergonomic for elderly living and modifications should be made to improve their quality of life.

One of the residents of Pondok MAAB
photo credit: Elderly researcher team.



Silver Nanoparticles: An Alternative Antibiotic

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Nanobiotechnology

has emerged as a recent technique providing simple, green and eco-friendly technology for the purpose of nanoparticles synthesis of variable sizes, shapes and for their unique chemical and physical properties. The smallest size of nanoparticles (1-100 nm) with high surface area to volume ratio make it potentially high for diverse applications in various fields such as medicine, industry, cosmetics and agriculture. Nanoparticles can be synthesized using both biological and chemical methods but the chemical method is not favorable due to some toxic chemicals which can absorb into the surface, thus making it unsuitable for human application.

Endophytes are microorganisms that grow intra-and/or intercellularly in the tissues of higher plants without causing over symptoms on the host. They are rich sources of bioactive natural products. In this study, endophytic bacteria were isolated from the leaves of higher plants taken from Pulau Langkawi and Pulau Tioman. There are several isolates of endophytes where their secondary metabolites showed anti-bacterial activity towards several pathogenic bacteria. One of the isolates identified as *Microbacterium paraoxydans* showed positive results of antibacterial activity towards all tested bacteria.

Nanoparticles were synthesized using enzymatic reaction using secondary metabolites excreted by *M. paraoxydans* added with silver nitrate solution. After 3 days of incubation, silver nanoparticles (AgNPs) was formed and proven by the changes of color of the medium from yellow to dark brown. This silver nanoparticles also showed positive effects on all bacterial pathogen tested.

The successful of this study opens a new avenue of research where the endophytic bacteria can also be used in the green synthesis of nanoparticles. After toxicity tests performed, AgNPs were also potential to be used as an alternative antibiotic for pathogens which already resistant towards existing antibiotics.

Towards Safer Skin Products

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"The expert researcher helps me to understand the technique using Franz Diffusion Cell better. It is a useful technique to measure drug release for formulation testing in SIRIM laboratory"

AIDAWATI MOHAMED SHABERY, SIRIM BERHAD

The need to have a perfectly healthy and beautiful skin is common among us. Health and beauty products abound to take advantage of this desire. But not all products are good for the skin.

In the dermatology research, drug formulations for delivery by percutaneous (skin) require data on efficacy, safety and toxicology in support of drug registration process. It is important for marketed skin products to be non-corrosive, non-irritant, non-sensitizing and have no toxicology effects.



How do we ensure the effectiveness of the product if it is unable to penetrate, and then absorbed through the skin? If it is low in penetration rate, a product is unable to reach the targeted area, and is rendered ineffectual. What if the penetration is high? For example, sunscreen lotion protects the skin from ultraviolet radiation; the penetration and absorption of the active ingredients into skin should be minimal. Unlike a nicotine patch, penetration and absorption of the active ingredient should be high entering circulatory system and other body tissues.

In vivo studies using laboratory animals have several disadvantages. The skin of laboratory animals does not resemble human skin in many aspects. For example, the skin of rats, mice and rabbits have no sweat glands and hair follicles compared to humans. There are also differences in skin thickness and composition of lipids in the stratum corneum which affect the permeability of the skin samples.

Therefore, if there is a need to investigate the penetration of drug formulations without the use of any animal, there are few choices. One of it is to use in vitro release testing (IVRT) using human skin sample and Franz Diffusion Cell. To be more effective, the methods can be combined with Follicular Closing technique (FCT) in which follicular penetration accounted for in skin penetration. The technique is simple, fast and inexpensive and readily available at the Center for Drug Delivery Research, Universiti Kebangsaan Malaysia at affordable prices along with consultation from expert researchers. Periodic workshops are also offered for those interested.

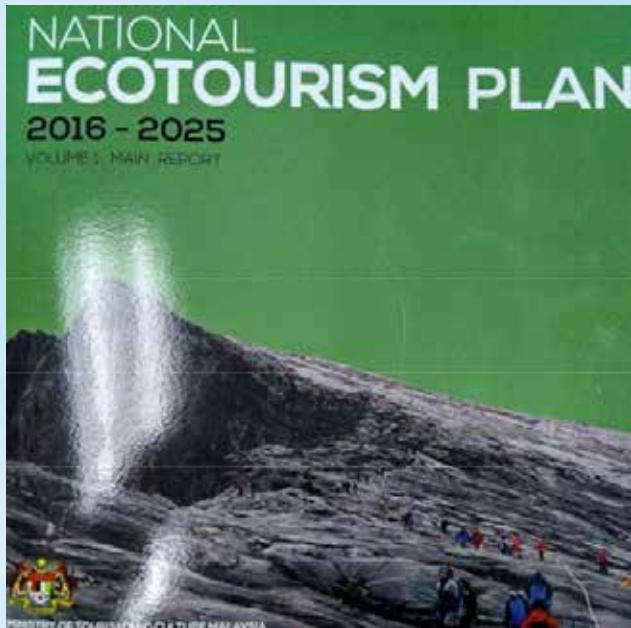


Mastermind of Tourism

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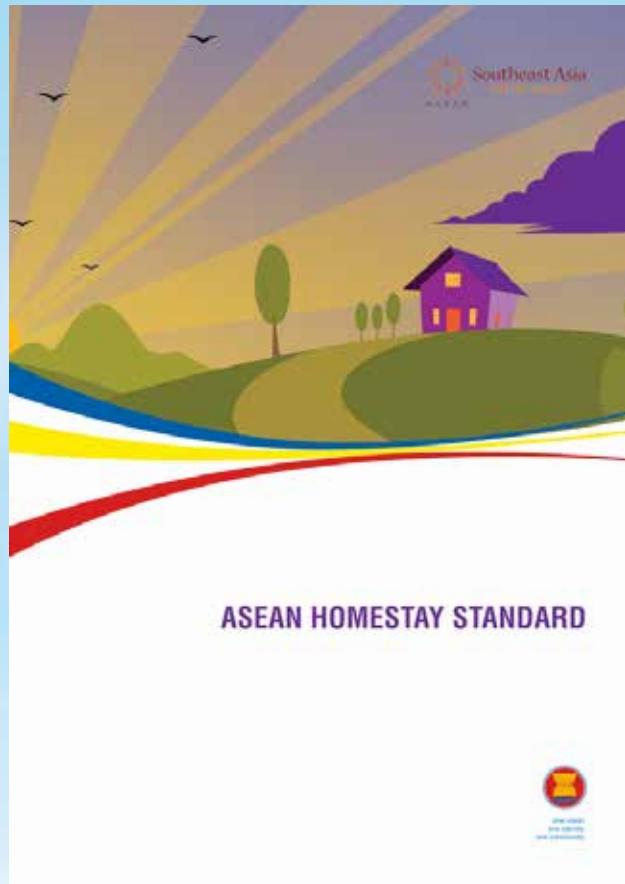
Being surrounded by engineers in UTM does not stop a group of researchers to find their unlikely niche (as far as UTM is concerned) in tourism planning and research. The research team works together at the Centre of Innovative Planning and Development (CIPD) which comprised of social scientists from different background.

One of the research strengths of the center is in policy research and development in tourism. Almost all research carried out by CIPD is documented in various policies endorsed by various government agencies to ensure a well-rounded tourism planning and development. The projects range from a relatively small scale study such as the potential of extreme sports as a main tourism attraction in Johor to one that is big as the National Ecotourism Plan.



The National (Malaysia) Ecotourism Plan 2016 - 2025

This effort in sustainable management of tourism has received international recognition by the International Union for Conservation of Nature and Natural Resources (IUCN) in 2016. The group has been lending their expertise to many ASEAN countries, such as being advisors to various tourism-related academic programs, and leading a project on community tourism to help improve the livelihood of the poor across Asia Pacific through tourism.



Developing a Homestay Standard for ASEAN



An old leachate contains various harmful substances that can harm the environment. Application of coagulation-flocculation in reducing pollutant from leachate was proven to be effective. However, the use of chemical coagulant will indirectly affect the health of living organisms. Hence, to reduce the effect, substituting the chemical coagulant with tapioca, a natural material, was investigated.

A combination of chemical and natural coagulant as a composite coagulant is able to simplify the process and offers many benefits. Instead of using a commercial chemically based coagulant (iron chloride), a new composite coagulant was produced from prehydrolyzed iron and tapioca flour (PHITF). This mixture was successful in removing suspended solids, colour, Chemical Oxygen Demand, and ammonia from an old landfill leachate, all of which threaten our environment.

An old landfill leachate from Matang landfill and Kuala Sembeling landfill were used in this study. It is found that the PHITF coagulation process resulted in better flocs and sludge formation compared to those produced from iron chloride which is currently widely used. Thus, it can be concluded that PHITF can be a potential coagulant for the treatment of old leachates in Malaysia.

Treating old landfill leachate with Tapioca Starch

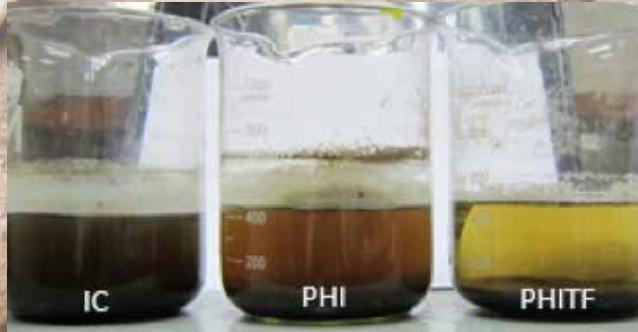
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An old leachate after treatment with PHITF



Application of coagulants tested at dose 0.2 g/L

Programme for Smoking Cessation in Malaysia

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Smoking is still the number one preventable public health problem, killing an estimated six million people each year globally. In Malaysia alone, 20000 deaths are directly attributable to smoking which affects nearly 1 in 5 Malaysians. Moreover, nearly RM2.9 billion is spent on treating three major health problems which are consequences of prolonged cigarette smoking namely cardiovascular diseases, respiratory diseases and cancers.

In light of this information, the Ministry of Health developed the National Strategic Plan 2015 – 2020 which aims for Malaysia to be smoke-free by 2045 and adopt an 'endgame' mentality towards the smoking epidemic. This policy was aimed to strengthen existing tobacco control measures which include both prevention and cessation. For the latter, this policy is a first in Malaysia which aims to upscale smoking cessation efforts in the country.

University Malaya, through the Nicotine Addiction Research Group of UMCAS was a founding partner in the mQuit program together with other agencies including Ministry of Health Malaysia. The team from UMCAS contributed their expertise through the development and delivery of training to healthcare providers in Malaysia to

upskill their knowledge on methods to assist smokers to quit through their training program SCOPE (Smoking Cessation, Organizing, Planning and Execution).

This training was initially developed through the grant UMRG049/09HTM in dentists before further developed for all healthcare providers through the Grand Challenge Grant GC004-15HTM. SCOPE is one of three training programs approved by the Ministry of Health to become a certified smoking cessation provider in the country.

Through SCOPE, the team in UM have trained nearly 3000 healthcare providers in Malaysia and have contributed to the growth of an additional 300 quit smoking service all over Malaysia. In order to further improve SCOPE, a doctorate candidate is presently evaluating this training program in six states in Malaysia encompassing nearly 1000 healthcare providers for a period of six months.

It is hoped that through our training and collaboration with the Ministry of Health through the mQuit program that Malaysia will achieve her target to be smoke-free by 2045.



Is that Water Safe to Drink?

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Pollution to drinking water sources continues to be one of the main concerns in Malaysia as a result of urbanization, lack in wastewater management and poor sanitation. The Malaysian government takes the issue seriously in order to achieve the aim of providing 99 % of population with sufficient good quality water at an affordable price by 2020.

Under Long term Research Grant Scheme (LRGS) awarded by the Ministry of Education, Malaysia in 2013, a total of RM 4,594,250.00 was funded to conduct research work in three different areas which include water resource abstraction, treatment process for removal of new emerging pollutants (NEPs) and acceptance of new technology in abstraction and treatment of water. The first project entitled "River Bank / Bed Filtration for Drinking Water Sources Abstraction" was focused on River

Bank / Bed Filtration (RBF) as an alternative treatment for polluted river as well as new resource for drinking water. Clean water from RBF is extracted from the collector wells situated on the banks at a certain distance from the river. This technology opens a new possibility of abstracting clean water for drinking purposes by utilizing both surface and ground water resources.

Given the title of "Micro- Pollutants Removal using Combined Membrane Filtration, Advanced Oxidation Process and Adsorption for Safe Drinking Water", the second project focussed on the advanced treatment processes to remove NEPs in water resources which include pesticides, industrial additives, pharmaceutical and personal care products. The third project with title of "Socio- Economic Cost Analysis of River Bank Filtration (RBF) and treatment Technology for Public's Drinking Water" concentrates on the public issues related to acceptance of new technology in abstraction and treatment of water, perception on water quality and services, and willingness to pay for possible increased water tariff.

Making our water safe to drink is indeed a priority. This research has successfully translated its findings to help the authorities and water operators to plan and strategize water related and suitable policies for the country.



English and the Employable Graduate

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The overall aim of this project is to investigate critical issues concerning the role of English proficiency and English communication skills in graduate employability, and to make recommendations to address them. Changes in the outside world require graduates to supplement their academic qualifications with evidence of proficiency in English to prepare them for the global employment market. Since our graduates are expected to operate effectively in English for international communication, it follows that our English language programme has to measure up to international standards.

The first task is to assess the performance of our students in Reading, Listening, Writing and Speaking according to the Common European Framework of Reference (CEFR) as the measure of international standards. Second, we investigate the communicative performance of students from the perspectives of teachers and employers. The former highlights what teachers regard as important in assessing communication skills, and the latter what employers want of their potential employees with regard to the use

of English in the world of work. This is complemented by investigating the 'fit' of university internship programmes for graduate employability.

These different sources of evidence were brought together to provide a coherent narrative of the main findings. The ideas generated on this project soon found an application in response to a request from the Ministry of Education to produce a Roadmap for the national English language programme.

Given the limited contact hours allocated for English, there is insufficient time for students to achieve the proficiency levels expected by employers on leaving university. The solution is a ten-year national plan or Roadmap for the systemic reform of English language education for all stages up to tertiary level, covering curriculum, teaching and learning, and assessment, and also teacher quality. The plan involves alignment to the CEFR, now prevailing in top-performing language education systems around the world, and sets employability as its target, using English as the means.

Mangosteen (*Garcinia mangostana* Linn.) dubbed the 'Queen of fruits', lives up to its name for its delectable unique taste. It can be found evergreen all year round scattered over South East Asian nations such as Vietnam, Indonesia, Myanmar, Thailand and Malaysia.

Mangosteens propagate via recalcitrant seeds. They are sensitive to cold and desiccation, so keeping them stored for long is difficult. Established seedlings usually take about six to twelve years to mature and have a lifespan of more than 25 years. Despite that, the sourly sweet fruit is exceptionally healthy due its high fiber and low calorie content with virtually zero cholesterol and unsaturated fat. This makes mangosteen a choice for highly nutritious diet. Additionally, mangosteen fruit and trees have many uses with a strong potential for commercial exploit.

The mangosteen has scores of biological and pharmaceutical properties. It is anti-inflammatory, anti-malarial, anti-allergy, antioxidant and anticancer. The mangosteen is rich with bioactive compounds, particularly xanthones which can be found in almost all

parts of the plant; trunk, leaves, fruit and even its resin. The highest level of xanthones can be found in the pericarp of mangosteen fruit and it has been used traditionally for centuries to treat wound and cure numerous ailment and complications like skin disease, ulcer and diarrhea.

There are many mangosteen-based products made for domestic consumers and international exports, for instance fruit juice, pill supplements, cosmetics and natural colouring. Therefore, as one of mangosteen producer countries, Malaysia should take the initiative in an effort to seize mangosteen's commercial value and spearhead more innovative applications of mangosteen and further empowers the agronomy around the region.

Our research in UKM has mainly involved the effort to preserve and propagate mangosteen seeds as well as understanding the fruit ripening behavior. This will help to ensure continuous supply of mangosteen for its export, local consumers and industrial applications.

The Many Wonders of Mangosteens

Empowering Stingless Bee Industry

Stingless beekeeping industry is a new branch of agriculture in Malaysia that started to leap in 2012. The stingless bees produce raw products such as honey, propolis and bee bread, which generate the industry worth more than RM200 million per year.

The contribution of this industry, however, has a greater impact in ensuring sustainable conservation of the country's biodiversity through pollination by stingless bees. Pollination by bees and stingless bees reached almost 50 percent in ensuring production of fertile seeds. These seeds will produce new trees as the source of food and fruits, production of oxygen, catchment water, and environmental preservation within our ecosystem. However, these bees are now threatened by habitat loss brought about by logging activities, residential development and pesticide use on farms.

Therefore, a project that is called Reinventing Honey Quality was launched for the purpose of improving the quality and marketability of local stingless bee honey to the international level. It is aimed to increase profitable income for the beekeepers and further instil their love for the bees. This approach will indirectly catalyse the bee conservation activities that ultimately ensure the sustainability of the bees for plant pollinations.

A number of social innovations has been created through this project such as bee-hive system called Mustafa-Hive for the production of hygienic honey, a book entitled 'Modul Asas Penternakan Lebah Kelulut' for the standardized farming method, as well as harvesting system and honey dehydrator called Honey Interlinked Dehydration and dispenser Apparatus (HILDA).

As an extension, honey production in the tropics regions faces the problem of yeast fermentation due to high percentage of water content that affects the quality of honey totalling nearly 300 tons per year. The active fermentation leads to by-products formation that causes the honey to become sour and foamy which indirectly inhibits domestic and foreign marketing. Therefore, the HILDA has been designed as an integrated platform for hygienic honey harvesting, water dehydration in honey and bottling. This system uses a closed dehydration principle at low temperature that does not impair the nutrient as well as maintaining the aroma of honey and inhibits fermentation activity simultaneously.

This invention allows mass production of honey to be produced and opens larger markets to the beekeepers to make this stingless bee industry is more profitable and preserve the nation's biodiversity assets at once.

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Rimba In The City

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The Rimba Project (RIMBA) is a UM Living Lab project based in the Rimba Ilmu Botanic Garden in the University of Malaya. RIMBA's mission is to conserve urban biodiversity with a more mindful approach to progress and development—to conserve and coexist with nature instead of recreating it within concrete confines.

With the support of UM's Development and Estate Management Office (JPPHB), RIMBA aims to improve green cover on by re-establishing the magnificent rainforest trees that once dominated the landscape, which will, in turn, attract small groups of animal wildlife to take up residence. RIMBA has acquired and raised trees of diverse rainforest species for urban landscaping on campus grounds.

However, UM as a haven for greenery and wildlife will not last if it goes unnoticed and unchampioned. To involve the campus community in the hands-on exploration of nature, The RIMBA Project actively organises awareness events to highlight the range of biodiversity on campus. Student volunteers inspired by RIMBA's activities have successfully led their own initiatives, such as UM Big Year, a yearlong birdwatching festival; Trailblazing, which created and launched two new trails in Rimba Ilmu; Creatures Theatre, creatively combining science with performing arts; and Trees of UM, which aims to identify, map and tag every tree on campus.



Trees for the Future: Student volunteers replant seedlings rescued from areas earmarked for development in Section 12, Petaling Jaya

Photo credit: Benjamin Ong

One of RIMBA's main thrusts is its biodiversity surveys. Partnering with experts from UM's Institute of Biological Sciences and powered by volunteers, RIMBA has recorded the plant and animal life within and outside campus borders in Petaling Jaya. These documentations of biodiversity in the city helped drive the conservation agenda in the university's development planning. The surveys also fostered fieldwork skills and an appreciation towards urban nature among volunteers.

If you would like to know more or to volunteer with RIMBA, visit our website (<http://umrimba.wordpress.com>) and follow The Rimba Project on Facebook.



Ketum: Menace or Medicine?

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Problems with the addiction and misuse of ketum, *Mitragyna speciosa* Korth, locally known as biak-biak or kratom, have resulted in negative perception of the plant in Malaysia. Ketum addicts are said to suffer from mental and physical illnesses. Hence, since 2003, ketum is classified under the Poison Act 1952 as a prohibited substance. A maximum penalty of RM10,000 or jail sentence not exceeding 4 years, or both can be charged if found guilty of buying or selling ketum beverage.

A ketum tree can grow over 9 meter tall. Its leaves are broad with dark green colour, but other colours such as light green or red can be found depending on the developmental stages and varieties. Ketum is used traditionally by pregnant women for energy recovery after labour as well as treatment for muscular pain and fever. It has also been used for the treatment of diabetes, helminths, and as aphrodisiac. Due to such richness in medicinal benefits, we need to understand this controversial plant from a scientific point of view.

Ketum has been a research focus due to the morphine-like psychoactive compounds which can alter brain function and suppress pain. Therefore, ketum has a high potential as an alternative treatment for drug addicts. Nevertheless, the effectiveness or suitable dose of ketum to be administered still requires a thorough clinical test. Furthermore, other compounds involved in the traditional usage of ketum for treatment are yet to be studied in detail.

Despite the recreational misuse of ketum, we need to be proactive in conducting comprehensive research to exploit its full potential for medicinal and pharmaceutical applications. This will contribute towards the country's economy through the generation of valuable agribiotech products in line with the aspiration of 2050 National Transformation (TN50).



Giving Hope to Breast Cancer Patients

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Studies have established a link between obesity and a higher risk of breast cancer because fat tissues can produce oestrogen. Our study indicates that fat cells

produce another hormone named adiponectin which influences cancer growth. Losing weight via diet and exercise can increase adiponectin levels and may be protective against breast cancer.

A study was conducted an anticancer drug named Anastrozole. Variabilities in two genes, namely CYP3A4*18B and CYP3A5*3, can influence anastrozole's metabolism where patients suffered higher incidence of side effects such hot flashes and mood disturbances. It is concluded that the investigated genes influence anastrozole's response.

Another study established the correlation of CYP1B1 gene with a patient's response to chemotherapy. Patients with homozygous variant 4326 GG had higher risks for chemotherapy resistance where administered drugs become less effective. Additionally, the expression of CYP1B1 was higher in patients not responding to chemotherapy indicating that these genes are important in determining the success of a chemotherapy.

A clinical study was also conducted to evaluate the effects of daily Tualang honey administration (20 g) for 12 weeks to breast cancer patients. It was established that the quality of life and the level of a bone formation



Identification of adiponectin in the laboratory using ELISA

marker increased while inflammatory markers remained unchanged among patients supplemented with honey. This indicates that honey is beneficial among post-menopausal breast cancer patients.

In another study, a new Health Education Module was developed to give a better understanding on breast cancer and the required coping strategies. The module can guide patients and provides support for health professionals on the psychological, physical, economical issues thereby improving their quality of lives. The combination of these studies gives hope to breast cancer patients. From providing advice on health practices to gene identification research, these patients can now expect better prospects for their illness.



From Bench to Community/Industry - Opportunities and Challenges

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Seri Energy Research Institute (SERI) has been involved in various technology knowledge transfer programs with the community and industry alike. We provide a general and specific measures in formulating the framework required when working with them. There are lessons learnt in these engaging programs outside the "bench" of university to the real practice of commercial industrial scale and its expectations.

However, businesses cannot afford to allocate its resources such as time, finance and manpower to meet the business objectives and returns in this competitive and stiff environment. Hence, companies today are pushing beyond these traditional boundaries by engaging universities/research institutions to help them solve complex problems, construct new market strategies, commercially viable new technologies and perhaps to explore major opportunities early in development.

They are also relying on such institutions more than ever before for the research part of their R&D formulas, to develop (or co-develop), license, and commercialize



new technologies. Both institution and industry have much to gain from these collaborations since they promote the discovery of new synergies and models that promise potential for ROI, improve shares value, market capitalisation and gaining confidence from shareholders.

SERI's vast engagement with the community and industry over the last 10 years provide both source of opportunity. At the same time, some negative experiences in the collaborations stemmed from conflicting goals and timelines. With few exceptions, the company's main target on short term goals to create and improve competitive products, while on the other hand, R&D institutions generally prefer longer time frames.

Despite these challenges, researchers are keen to translate their research finding into positive outcomes for industry players and communities locally and internationally.



Malaysian Health and Adolescents Longitudinal Research Team Study (MyHeARTs)

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High incidence of obesity among adolescents should be treated as a serious problem as it can continue into adulthood if not intervened (MOH, 2011). Thus, this observation is of public health importance with the identification of overweight as a risk factor for exposing individuals to chronic non-communicable diseases such as type-2 diabetes mellitus, cardiovascular diseases and certain types of cancers. MyHeART (Malaysian Health and Adolescents Longitudinal Research Team) study is a longitudinal cohort study of about 1400 schoolchildren attending 15 public secondary schools from Kuala Lumpur, Selangor and Perak.

The study used a stratified sampling design to select the participants which were first examined at the age of 13 years and then followed up at the age of 15 and 17 years. It aimed at examining the risk factors of non-communicable diseases (NCD) among adolescents by determining:

- how lifestyle factors (e.g. diet and eating habits, physical activity including leisure activities, substance use) in early adolescence may influence the development of chronic non-communicable disease in early adulthood;
- how psychological and social process can shape high risk behaviours pathways of young adulthood;
- the trends of prevalence of NCD risk factors among adolescents.

This study is the first longitudinal study among adolescents in Malaysia with comprehensive



assessment of blood profile, diet, physical activity level and bone mineral content which will provide information to develop effective intervention strategies (implementation science) envisaged in preventing chronic non-communicable diseases in the future.

Based on the longitudinal assessment, rural female adolescents tend to have high BMI and body fat composition due to lifestyle factors including poor physical activities. The originality of the food frequency questionnaire for adolescents developed from this study was proven by obtaining its patent (LY2016000386).

Our results demonstrated that adolescents from the rural area were at higher risk of developing NCDs compared to their urban counterpart. We managed to create awareness on the importance of empowering health both at student and school levels. Results from this study had encouraged the parents to seek medical attention for their children's health and it is hoped to assist in developing public health policies focussing at the adolescents with the aim to minimise the dreadful NCD burden in adulthood and health disparity between the rural and urban in the near future.



The Dead Tells Tales: Applications of Forensic Anthropology

A collection of bone fragments had been found in a bush area in Ulu Langat on a brink of a ravine. Police were called to investigate the case, and make identification of the deceased to proceed with further investigations to determine whether this case was murder, suicide or natural death. As usual, the hospital was called to assist in the investigation of the case. The remains were taken to the hospital, and upon investigation, the skull was examined using CT scan, and analysed by 'Geometric Morphometrics' (GM).

This study was able to help the police to identify the individual, who was an adult Chinese lady. Having recognized the identity of the woman, the police were able to detect that she was murdered and dumped in the bush. Further investigations had led the police to the woman's husband for identification. Upon investigation, the woman was poisoned via her drink during a meeting with her client for some business dealings, after which she was raped and thrown in the bushes. Through GM, the dead "revealed" how her life ended.

Geometric morphometric study on the human skull had helped the police and the courts in determining the identity of the deceased person, without which the police were not able to proceed with further investigation. The GM method had been used to analyze the morphology of skull using statistical analysis with design specification for data analysis. This study had proved useful and effective in collecting detailed information from CT scan of skull in the development of a computer software for forensic human identification applications in determining sex, age and race.

This case was brought to the court for presentation of evidence, and the accused was arrested and given a sentence. From the information gathered, the accused had committed similar offences to several women in the past for business dealings, and these women had been raped and dumped in undergrowth, suffering the same fate as the Chinese woman. The court was satisfied with the results of this study and justice was served.

Fostering Membrane Science for the Sustainability of Green Technology

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Under the vision of "Fostering the fundamental Science of Membrane Technology for the benefit of bottom billions", the Membrane Science and Technology Cluster (MSTC) of Universiti Sains Malaysia, established in 2011, works to develop the next generation of membrane technology to deliver Malaysia and the world a sustainable green society. Green society symbolizes the sustainable development of modern communities in social, economic and industrial activities.

In its recognition of humanity as a participant in the ecosystem, the cluster's mission is centred on pioneering the membrane science fundamental for the sustainability of green technology via water reclamation, biomedical advancement and energy revolution. Water shortages, deterioration of water quality and environmental constraints, have led to an increased interest of recovering water in many parts of the world.

Water reclamation is carried out using membrane technology which requires zero chemical usage with small carbon footprint. Besides clean water, sustainable green society requires biomedical enhancement to improve public health and reduce diseases. Advanced biomedical technology emphasizes the application of membrane science and technology principles in developing diagnostic test and producing drugs. Energy, the main resource of humanity has been recently associated to many environmental issues including the climate change due to the predominantly burning of fossil fuels and the direct impact of greenhouse gases on Earth.

Most of our research conducted under this cluster are moving towards translational research, which ensure its relevancy with the quadruple helix effects. For example, the utilization of membrane technology for water treatment during flooding and zero-discharged membrane for the treatment of the palm oil mill effluent. Indeed, the membrane cluster is ready to produce and commercialise the membranes for various applications. These achievements enable the MSTC to build linkages with local industries and foreign universities amongst others Istituto Perla Technologia Delle Membrane Itali, Imperial College (UK), Swansea University (UK), National University of Singapore, Carnegie Mellon University (USA), Sultan Qaboos University (Oman).



Biological Micro-Electro-Mechanical Systems (BioMEMS) Sensors for Biomedical Applications

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Wearable medical devices is a fast-developing niche industry with increasing relevance towards the pursuit of quality healthcare. The use of wearable medical devices will be able to simplify healthcare monitoring – especially for patients who do not stay long-term in hospitals – through the continuous collection and storage of patient data. The collected data can be viewed by medical personnel at a later date to evaluate the patient's health status. Current commercial devices utilise Biological Micro-Electro-Mechanical System (BioMEMS) technologies to monitor heart rate, blood pressure etc. but trends are gearing towards applying this technology to develop wearable bio-sensing devices for non-invasive patient monitoring and disease screening as well.

The Centre for Innovation in Medical Engineering (CIME), founded in 2008 by Prof. Ir. Dr. Fatimah Ibrahim under

the Department of Biomedical Engineering, Faculty of Engineering, University of Malaya, is a specialised laboratory applying BioMEMS technologies towards biological detection for patient monitoring and disease screening. Research efforts are focused towards integration and collaboration with industrial players to commercialize patents and medical device innovations developed in CIME.

The ongoing research work at CIME has resulted in the development of 3 medical devices which are in the commercialisation process: SmartMF (a non-invasive, multi-frequency(MF) bioimpedance measurement device for disease monitoring), MyEMG (a wearable non-invasive electromyography(EMG) monitoring system for low-back pain), and BluBOX (a wearable male sexual health monitoring system).

CIME carries out activities related to research and development, consultancy, knowledge hub, training and community services. CIME has linkages ranging from Ministry of Health (MOH), Ministry of Education (MOE), Medical Device Authority (MDA), SIRIM, and the private sector. CIME continues to serve as a focal point for government agencies, universities, research institutes and various medical industries to integrate advanced technologies into the healthcare industry.



Newspaper article dated 29 June 2017 introducing the BluBOX (A Wearable Male Sexual Health Monitoring System), published in Berita Harian.



News write-up on MyEMG (A Wearable Non-Invasive Low-Back Pain Monitoring System) device, published in Kosmol dated 1 March 2017.

Drugs : The Invisible Emerging Pollutants in Water

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The current supply of fresh water in Malaysia as feeders to water treatment plants is under threat from a host of pollutants. Frequently, treatment plants have to shut down due to high ammoniacal nitrogen content, high manganese, low pH and lubricant spillages. Apart from these well known pollutants there is also a new variant known as emerging pollutants. Generally, two big groups of chemicals fall within the definition of emerging pollutants namely drugs used as pharmaceuticals and personal care products. Some of these drugs and personal care products are also endocrine disrupting compounds (EDC), which are capable of disrupting many major bodily functions.

Drugs in particular which are not fully utilised by humans or animals thus will be excreted through the urine or faeces. Flushing of unused medicine is of minor importance. The work done by our team indicated the presence of some drugs such as pain killers (acetaminophen), caffeine, diclofenac-Na, prazosin, carbamazepine and simvastatin in surface water and some in sewage treatment plant effluent at measureable concentrations. For the hospital effluents, caffeine and mefenamic acid were detected at the highest concentrations of 1407 and 95 ng/L, respectively. The detection of these drugs required the development of new methods to detect pollutants at parts per trillion level utilising UKM's very sensitive instrument (LC-TOF-MS).



Under the Economic Transformation Plan (ETP), Malaysia is geared to be a high income nation befitting a developed nation. The water standard that is currently in use is the minimum standard used by WHO. Malaysia is only monitoring 60 parameters compared to 180 in Canada.

There is currently no regulatory requirement for the monitoring of drugs in drinking water as there is no known report on the health impact of these emerging pollutants. However, it must be stressed that these pollutants are designed to work at low levels, and some which are lipophilic can accumulate in the fat cells and cause harm through chronic effects. The way forward is to analyse for these emerging pollutants in our rivers.

Finally, the irony of this phenomenon is that in this modern world that we live in, drug therapy has become a way of life to improve health. However, these drugs are re-entering our eco-system through our waters causing potentially adverse effects to our health.

Rebuilding a Broken Trust: The PEACE Initiative

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Malaysia is greying, no doubt. As life span prolongs and fertility drops, our elders are rapidly increasing – a great achievement of public health. But there is one problem: we are not loving them enough. Studies around the world have shown that elder abuse and neglect (EAN) is a universal dilemma and a growing threat on global health. Approximately one in ten older person experiences abuse at the hands of their loved ones.

Given the worrying statistics, we from the Julius Centre University of Malaya (JCUM) launched the Prevent Elder Abuse and negleCt initiativE (PEACE), aiming specifically at addressing this issue. As the nature of EAN is complex, our approach in PEACE is diverse and works at multiple levels. We engage with various stakeholders including researchers, healthcare providers, social workers, policy-makers, legislators and the media in order to tackle the problem holistically. Starting with Negeri Sembilan as the pilot phase, we plan to gradually expand PEACE efforts to other states. Among PEACE activities and achievements are:

1. Community engagement programs involving doctors, nurses, caregivers and civil society. These include training workshops (for healthcare personnel and caregivers), awareness campaigns (World Elder Abuse Awareness Week and National Senior Citizens Day) and public forums.
2. Research and academic efforts for data collection and systematic investigations of EAN which have led to multiple publications of scientific writings, including training modules and guidelines for EAN detection and management suited for local needs.
3. Reaching out to a wider audience through the mass media (radio, newspapers and TV). The PEACE initiative is the first of its kind in Malaysia. In the long-term, we hope to safeguard the well-being of our senior citizens and protect them from harm. As what Malaysians today enjoy is a result of our elders' hard work, they deserve more love and appreciation.



Water Warriors

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Water conservation includes the protection of our water bodies. Lakes, ponds, rivers and streams are home to diverse animals and plants. Get a net, start scooping in any nearby stream and you will find dragonflies or damselflies nymphs residing inside the water if it's clean enough. Many were surprised to know that you can even find prawns, water cockroaches and water spiders there and not forgetting the many fishes (big or small), waterfowls, amphibians and reptiles roaming around. It falls into our responsibility to care for these God-given gifts.

Water Warriors (WW) Campus Sustainability Living Lab is an action research group for water conservation at the University of Malaya. Comprising of dedicated student volunteers, alumni staffs, volunteer lecturers and even retired staffs - WW began as a bottom-up movement in 2013 to help rehabilitate Tasek Varsiti, the university's beloved lake located at the heart of the University of Malaya campus. It was an ailing back then, but through a holistic approach the team managed to revive the lake and make it a priority for the universities' long-term conservation plan until today. Initially, the "heartware" (humanistic) approach was used through

citizen science activities, YouTube video production on the lake as a heritage for the university titled 'Tasek Varsiti: Then and Now', roundtable session with all the relevant stakeholders and a series of communal clean-up. Other aspect of "software" (institution, rules and regulation) and "hardware" (science, technology and instrumentation) were also practised. Overall, the lake will now transition more sustainably, not only for recreation, but also for maintaining its conservational, historical and educational value.

Today the lake has been transformed to an "open classroom" with various environmental education activities conducted such as tree walk, water monitoring, nature hunt, Responsible Lakers and celebrations of World Wetlands Day, Lake Open Day and others. The role of WW also goes beyond that as we also provide support in terms of research, community engagement and working with the development office on any matter relating to water conservation. Currently WW has expanded its activities to broader water issues on campus by also looking into the conservation of other water bodies such as rivers and streams and dealing with water consumption issues.

For more information, feel free to visit our website: umwaterwarriors.wixsite.com/tasek or Facebook: UM Water Warriors

Photo credit: Siti Norasiah Abd Kadir
Image 1: Water quality monitoring conducted at the lake to ensure the health of the lake's ecosystem and its suitability for recreational purposes.



Photo credit: Siti Norasiah Abd Kadir
Image 2: Lake reopening ceremony officiated by University of Malaya's Deputy Vice Chancellor (Development) by being the first to jump into the lake.





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