

MRUN

Malaysia Research University Network **BULLETIN**



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BEYOND
DISABILITIES**

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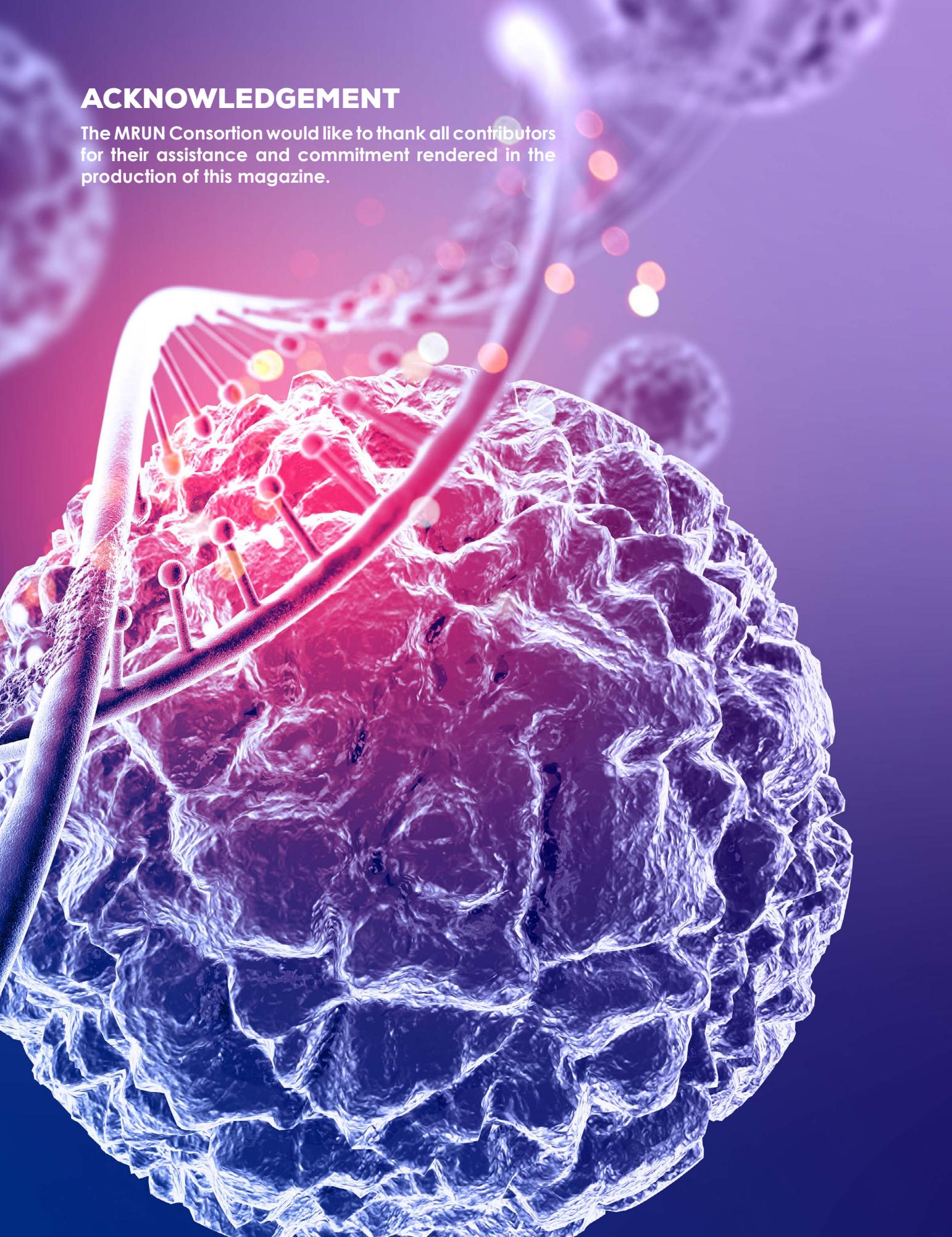




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BE ABLE:

Venturing Beyond Disabilities

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Be Able: Venturing Beyond Disabilities is a platform for educators to educate disabled individuals on how to properly use assistive devices, thus empowering them to communicate better. This program also allows them to explore sports activities for self-rehabilitation. The main objective of the program is to educate People with Disabilities (PWD) on how to use their assistive devices correctly; these include wheelchairs, prosthetics, and orthotics while going through their daily activities in a metropolitan urban city such as Kuala Lumpur.

Through this programme, the PWD community can share their opinions, experiences,

and actual needs with the researchers, institution, and designers. They will also use the program as a platform to motivate themselves in communicating, and improving their performance and participation in sports activities e.g. para-sports, thereby enjoying a better quality of life.

The rationale came about when the researchers realized that many PWD do not understand how to utilise their assistive devices correctly and lack confidence in communicating with others. They are unaware of the numerous activities that they can pursue.

The program focuses on the PWD community from

Pusat Latihan Perindustrian & Pemulihan (PLPP) who have an average of 50 PWD students per year, 10 lecturers from PLPP, 20 undergraduates, and 5 staff members. This program was carried out using the facilities in UM to serve the PWD community. It includes 3 important aspects: 1. Teaching and rehabilitation services, 2. Social and rehabilitation services, 3. Sports and recovery.

This program narrows the gap between the PWD community and the university at which they regularly attend consultation sessions. Indeed, the programme provided a fruitful learning and socializing experience for both PLPP and students.

Production of “Green” Succinic Acid from Renewable Resources

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Succinic acid, a four-carbon dicarboxylic acid, is one of the most important commodities which serves as the precursor or starting material for many industrially valuable products such as shown in Figure 1. The common method for succinic acid production is through a chemical route using liquefied petroleum gas or petroleum oil as starting material.

Nonetheless, there has been growing interest in the production of “green” succinic acid from renewable resources such as biomass. Malaysia, as a country that is blessed with the palm oil industry, has the potential to use oil palm biomass for the bio-production of various types of chemicals including succinic acid. This biorefinery approach will provide another means for a more sustainable

development of the chemical industry. In this project, succinic acid was produced through a fermentation method using oil palm frond (OPF) bagasse as the only carbon source. The broth from the fermentation process has to undergo a separation and recovery process in order to obtain pure succinic crystals. Typical downstream processes require the use of energy intensified unit operation such as evaporation during the concentration stage. Evaporation not only requires high energy but also operates at higher temperatures which may degrade the product.

We have introduced a novel alternative low-energy method for the downstream recovery of succinic acid through the use of integrated forward-osmosis (FO) and crystallization technique. The overall findings

showcased the remarkable ability of FO to increase the concentration of succinic acid in broth solution, which is a vital part of the FO feasibility study. Succinic acid crystals were then successfully recovered from the FO-concentrated broth in the final crystallization step. The purity and yield of succinic acid crystals were 90.52% for the treated broth.

The visual appearance of the final crystal product exhibited high purity white/colorless succinic acid crystals. This research successfully developed a simple, feasible, effective, and environmental-friendly downstream recovery process, exhibiting broad and promising prospects for the biorefinery approach to succinic acid production.

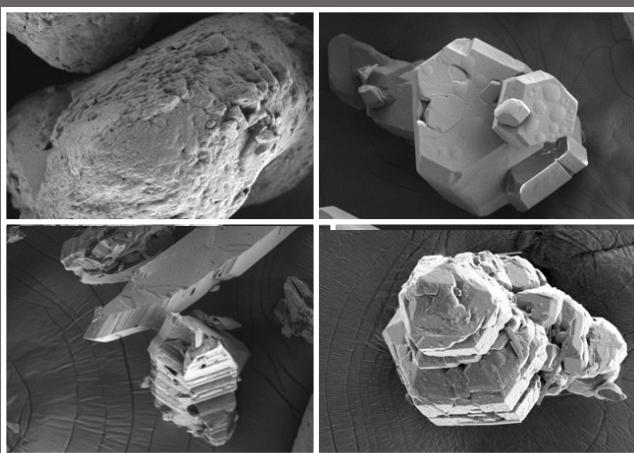


Figure 2 SEM micrographs of succinic acid crystals:

- (a) analytical grade succinic acid
- (b) succinic acid crystals produced from Synthetic B solution
- (c) & (d) succinic acid crystals produced from FO-concentrated fermentation broth
- (e) actual photo of the white crystalline succinic acid crystals produced from FO-concentrated fermentation broth

WHAT'S UP? SMALLHOLDERS' VIRTUAL COMMUNITIES

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Who would have guessed that the handphone would become an important gadget for oil palm planters? Indeed, together with apps such as WhatsApp, WeChat, Instagram, Messenger, Facebook, and Skype, the industry is alive 24/7.

Smartphones have become the farmers' extended mouthpiece, supporting the intensive dissemination of agricultural information among farmers' groups, as well as enabling access to crop production and technology information. Social media is an online communication channel that allows users to interact easily regardless of geographical location, and to share and discuss information via a combination of multimedia elements comprising texts, images, videos, and audio files. Welcome to the 21st century plantation industry in which the emergence of social media has greatly eased communication channels.

Smallholders in Bintulu, Sarawak, for example, have taken to technology like ducks to water. WhatsApp group DOPPA (Dayak Oil Palm Planters Association) and the Sarawak Palm Oil Association (PPKSS) group were created to enhance communication and provide support for smallholders. Furthermore, this virtual community facilitates a faster sharing of information that includes crop-related experiences and matters relating to land management in Sarawak.

The technologically savvy smallholders acknowledged that social media plays a significant role in facilitating

communication and information sharing. For example, community members who were involved in an accident or have sustained financial loss in longhouse fires are greatly helped by financial aid from others in online community groups. A few of the informants stated that "Most longhouses have WhatsApp groups"; and "there are activities that we have conducted to assist members when a tragedy strikes. For example, [after] a longhouse fire, we collected money to help fund them"; and "...we created a group, because it involves clusters, groups, so it's easy for us to ask in terms of questions between experts in that field and we have a group manager." These voices show the importance of almost instantaneous support from their own communities.

The top-down approach which once dominated the way information is spread amongst smallholders has now changed; social media has simplified the bottom-up approach. Besides the easy-to-use method, the use of social media also facilitates interactions among smallholders and also with Tunas officers. Smallholders' initiatives with palm oil authorities in expanding and strengthening the wide use of social media and effective social interaction and agricultural activities are required in order to contribute not to only the development, progress, and innovation of the palm oil industry, but also to the sustainability of the smallholders themselves.

Tackling Human Leptospirosis

Human leptospirosis is an important emerging zoonotic disease in Malaysia with an average incidence of 3.02 per 100,000 population. The fatality rate in Malaysia is 1.3%–7.6%, the majority of which fall into the 20-50 age bracket. It is caused by a bacterium identified as the *Leptospira* that is spread by carrier animals, especially rats and rodents, as well as wildlife, livestock, and domesticated animals. Currently there are many challenges in clinical management, laboratory diagnosis, and

prevention. Clinically, it mimics other diseases, and more often than not, further complications arise. The laboratory tests are also not accurate. Prevention is a huge challenge when dealing with community engagement and elimination of animal hosts.

This research program adopts an integrative and comprehensive approach in tackling human leptospirosis in Malaysia. There are four inter-related projects,

1) Identification of early diagnostics and prognostic biomarkers for leptospirosis patients comprising clinical, biochemical, proteomics, metabolomics, and transcriptomics aspects. Preliminary data showed certain biomarkers, proteins, and genes are associated with severity and prognosis of the disease.

2) Determination of leptospirosis disease burden in Malaysia and development of detection methods for leptospirosis genes. A high seroprevalence was shown among garbage collectors and night market traders. An algorithm of a combination of molecular and serological tests are currently being tested. We are also developing rapid tests utilising real time PCR and LAMP technologies.

3) Identification of sociobehavioural factors and risk perception, and health economic assessment of leptospirosis activities. These involve observational and interventional community studies in which interactive health education modules were developed and evaluated. Cost effective analysis revealed focusing on prevention would be more effective than disease management.

4) Identification and biological study of potential animal hosts, and determination of effective control measures which will focus on understanding the home range, habitat selection, activity, and movement patterns of potential hosts; identification of diversity, composition, structure, and population of hosts. This comprehensive research program is expected to reduce leptospirosis morbidity and mortality.





HEAVY METAL REMOVAL VIA NANOTECHNOLOGY

**School of Materials and Mineral
Resources Engineering**

Zainovia Lockman | Universiti Sains Malaysia

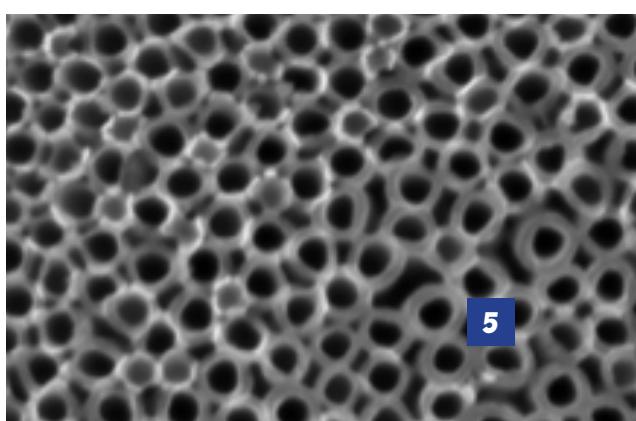
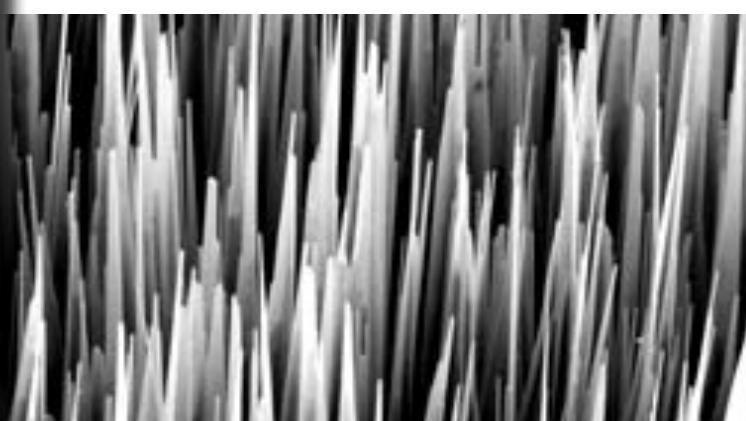
Heavy metals like cadmium, lead, chromium(VI), arsenic, and mercury pollution in water and soil continues to receive more attention in recent years as they are persistently high in toxicity and relatively non-biodegradable compared to organic pollutants. While it is already worrying that heavy metals appear to exist in large quantities in water, their effects especially in paddy fields have now gained much more attention due to an obvious reason: we eat rice.

Heavy metals are understandably undesired. Lead for instance is often associated with damage of the central nervous system, leading to a reduction of intelligence quotient points especially in children. Mercury is also known to adversely affect children's growth and behaviour, and is potentially detrimental to the central nervous system, particularly during foetal development. Chromium(VI) and arsenic are carcinogens. The occurrence of some of these heavy metals in rice grains, paddy leaf, stem, and root has been characterised and reported vastly in the literature.

Although pollution levels are still below the standards

established by the Malaysian Food Regulation 1985, bioaccumulation is nonetheless inevitable and heavy metals can exist in the human body for a long time. It is therefore best to prevent heavy metals from entering soil and water for irrigation. To do so, the source of discharge must first be identified.

Human activities, domestic waste, effluvia, and agricultural activities are known sources which can be controlled. For example, heavy metal laden effluvia from industrial wastewater can be controlled by various means, one of which is an effective removal system. Among various processes that can be adopted, nanotechnology appears to have significant contribution especially in removing extremely diluted amounts of heavy metal ions. The reduction of certain heavy metal ions to more benign levels can be achieved through the use of certain nanomaterials with semiconducting properties such as oxide nanotubes or nanowires. These oxides are required to be illuminated with light in order to generate a significant number of electrons for reductions to happen.





PROMISING TYPE 2 DIABETES TREATMENT

Prof. Dr. Mohamad Roji bin Sarmidi, Dr. Cheng Kian Kai,
Dr. Mohamad Hafizi bin Abu Bakar | University Teknologi Malaysia

Insulin resistance is characterized by hyperglycaemia, dyslipidaemia, and oxidative stress prior to the development of type 2 diabetes mellitus. Accumulated evidence has shown the significant correlations between mitochondrial dysfunction and inflammation with insulin resistance. In our laboratory, we used different cell models to uncover the roles of mitochondrial dysfunction and inflammation in insulin resistance and type 2 diabetes.

In our previous study, we used antimycin A (AMA) to induce mitochondrial dysfunction and insulin resistance in a human skeletal muscle cell model. The cells were then treated with celastrol, an anti-inflammatory compound. We found that celastrol treatment improved the insulin-stimulated glucose uptake activity of AMA-treated cells apparently via PI3K/Akt pathways, with significant enhancement of mitochondrial activities. Furthermore, celastrol has also prevented increased levels of cellular oxidative damage where the production of several pro-inflammatory cytokines in cultured cells was greatly reduced. Celastrol significantly increased protein phosphorylation of insulin signaling cascades with amplified expression of AMPK protein and attenuated NF- κ B and PKC ϵ activation in human skeletal muscle treated with AMA. The improvement of insulin signaling pathways by celastrol was also accompanied by augmented GLUT4 protein expression. Taken together, these results suggested that celastrol

may protect against mitochondrial dysfunction-induced insulin resistance in human skeletal muscle cells.

Adipose tissue is one of the important peripheral tissues that helps to regulate whole-body homeostasis. A metabolic imbalance of energy productions and impaired oxidative phosphorylation in this target tissue may lead to mitochondrial dysfunction. Previously, we studied the direct effects of mitochondrial dysfunction on the lipolysis activity and relative distribution of lipids in adipocytes. The induction of mitochondrial dysfunctions in adipocytes was performed with the treatment of two common mitochondrial respiratory inhibitors, antimycin A (Complex III) and oligomycin (ATP synthase) on 3T3-L1 adipocytes. We found that in the presence and absence of insulin, both respiratory inhibitors have significantly reduced intracellular ATP concentrations within adipocytes. Furthermore, both drug treatments have resulted in the significant elevation of free fatty acids and glycerol release into the media compared to control. The treated cells were also found to exhibit an irregular intracellular accumulation of lipid droplets. Our results also demonstrated that lipolysis activity and abnormal intracellular lipid accumulations were up-regulated in the event of mitochondrial dysfunctions in adipocytes.

Based on those findings, we conducted a separate experiment to investigate the direct effects of celastrol (potent

NF- κ B inhibitor) upon mitochondrial dysfunction-induced insulin resistance in 3T3-L1 adipocytes. Celastrol ameliorates mitochondrial dysfunction by altering mitochondrial fusion and fission in adipocytes. The levels of oxidative DNA damage, protein carbonylation, and lipid peroxidation were down-regulated. Furthermore, the morphology and quantification of intracellular lipid droplets showed a decrease of intracellular lipid accumulation with reduced lipolysis. Moreover, a massive production of the pro-inflammatory mediators including tumor necrosis factor- α (TNF- α) and interleukin-1 β (IL-1 β) were markedly depleted. Insulin-stimulated glucose uptake activity was restored with the enhancement of insulin signaling pathways. The significance of our study leans towards an understanding that the treatments modulated towards the knockdown of the NF- κ B transcription factor may counteract these metabolic results exacerbated in our model of synergy between mitochondrial dysfunction and inflammation. These results have demonstrated that NF- κ B inhibition modulates mitochondrial dysfunction induced insulin resistance in 3T3-L1 adipocytes.

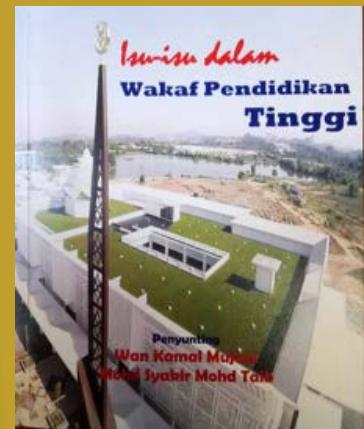
Taken together, the studies conducted in our lab provide substantial support that link mitochondrial dysfunction and inflammation to insulin resistance. Further studies to include metabolomics together with other omics techniques are warranted towards the establishment of a detailed mechanism associated with the disease processes.

WAQAF FINANCING FOR HIGHER EDUCATION

Prof. Dr. Wan Kamal Mujani
Head of Research Program and Project

For both public and private higher learning institutions in Malaysia, the generation of income through endowments and Wakaf are highly recommended for financial self-sustainability. For public universities which, in general, are recognized as non-profit organizations, being on the receiving end of large endowments reflects a robust ability to obtain revenue through grants. Unfortunately, the implementation of Wakaf in Malaysian universities is relatively more complicated than straightforward grant allocations. Unlike endowments or other forms of income generation tools for universities, Wakaf is unique and subject not only to legal restrictions but also religious principles that must be adhered to.

This research comprised six sub-projects and the findings indicated that the level of understanding and perception of the multi-ethnic community of Malaysia towards Wakaf for higher education in the country is still low. The proposal to establish Malaysia's Higher Education Wakaf Bank through the cooperation of higher education institutions with commercial banks in Malaysia is a way to realize higher education based Wakaf. At present, several models for implementation have been identified and could potentially be implemented in Wakaf public universities in Malaysia.



In addition, taxes could also play an important role in developing Wakaf higher education through improved taxation laws. In addition, higher education institutions would benefit greatly from entrepreneurship through the Wakaf Corporation to pave the way for successful Wakaf based higher education.



PRICELESS TIGER MILK MUSHROOM (TM02®)

SHIN YEE, FUNG

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The tiger milk mushroom has long been extolled for its medicinal properties; it has been used by the local Malay, Chinese, Temuan, and Semai people for the treatment of asthma, cough, fever, cancer, liver-related illnesses, joint pains, and as a tonic. The history of its usage dates back almost 400 years, but there are no records of scientific studies done due to the unavailability of sufficient samples. Even when there were samples collected from the wild, the supply and quality were inconsistent.

One of the most utilized species of tiger milk mushrooms, *Lignosus rhinocerus* (registered as TM02®) was successfully cultivated in 2009 thus enabling scientific investigation to be performed to validate its traditional use. The Medicinal Mushroom Research Group (MMRG) pioneered the safety assessment of TM02® to ensure that the cultivar is competent for consumption and to elucidate the genome of the *L.rhinocerus* species.

Following the initiative of safety assessment, scientific validation of TM02®'s nutritive composition and bioactive properties were investigated alongside the wild type. Among the properties that have been investigated to date are antiproliferative,

anti-inflammatory, antioxidative, nutritional, immunomodulatory, and neuritogenesis activities of the *L. rhinocerus*. A community-based quality of life (QoL) survey was also conducted among the 100 volunteers who had taken TM02® for various health concerns.

The scientific findings have verified some of its traditional applications and revealed interesting data which shows potential for it to be further developed into possible nutraceutical components. The MMRG has filed several national patents from their discoveries and collaborates actively with their industrial partner, LiGNOTM Biotech Sdn. Bhd., the world's first commercial producer of TM02®, who owns an in-house proprietary method for the quick cultivation and mass production of TM02®.

Our research group also works alongside collaborators from the Chinese University of Hong Kong, the University of Nottingham (UK and Malaysia campuses), the University of Glasgow, Chulalongkorn University, Academia Sinica, the University of Western Australia, and MAHSA University to unveil potential biomolecules that may form a valuable foundation in pharmaceutical and industrial applications.



Managing Respiratory Diseases through RESPIRE

PROF. DR. EE MING KHOO (UM), LEE PING YEIN (UPM), PROF. MADYA DR. SAZLINA SHARIFF GHAZALI (UPM) | UNIVERSITI PUTRA MALAYSIA & UNIVERSITI MALAYA

RESPIRE, which stands for the National Institute for Health Research (NIHR) Global Health Research Unit on Respiratory Health, is a programme led by the University of Edinburgh, United Kingdom. It is funded by the National Institute for Health Research (NIHR), United Kingdom Global Health Research Programme, using Official Development Assistance (ODA) funding. RESPIRE aims to reduce the impact and number of deaths caused by respiratory diseases in Asia. It is a research partnership with collaborators from four countries: Bangladesh, India, Malaysia, and Pakistan. In Malaysia, the partners are the University of Malaya (UM) and Universiti Putra Malaysia (UPM). This is a 4 year programme which began on August 1, 2017 and is projected to end on March 31, 2021. The amount of funding allocated to Malaysian partner universities (UM and UPM) currently exceeds £700K (RM3.69 million). The principal project leader for Malaysia is Professor Khoo Ee Ming from the Department of Primary Care Medicine, Faculty of Medicine, University of Malaya. The co-project leaders for this project from UPM are Associate Professor Dr. Lee Ping Yein and Associate Professor Dr. Sazlina Shariff Ghazali, from the Department of Family Medicine, Faculty of

Medicine and Health Sciences, UPM. A RESPIRE Stakeholder Engagement Workshop was successfully conducted on October 4, 2018 at the Faculty of Medicine, University of Malaya, Malaysia. This one-day event was organised by the RESPIRE Malaysia team from the Department of Primary Care Medicine, Faculty of Medicine, University of Malaya (UM) and the Department of Family Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia (UPM) and supported by the RESPIRE Stakeholder Engagement and Governance Platform. The Workshop aimed to engage with RESPIRE stakeholders, secure their involvement, and share information on the role of stakeholders as collaborators in RESPIRE activities.

A total of fifty participants took part. They included stakeholders from the Malaysian Ministry of Health, Family Medicine Specialists from health clinics in Klang, the Negeri Sembilan Health Department (JKNS) in the Port Dickson District Education Office, schools in the Port Dickson district, National Clinical Research Centres (CRC), and non-governmental organisations such as KASIH and HOSPIS Malaysia. Dr. Poonam Malik, the Global Respiratory Health Partnerships Manager from the University of Edinburgh, conducted the

workshop.

Professor Dr. Ee Ming Khoo, the principal investigator of RESPIRE Malaysia has emphasised the importance of stakeholders in research, "They represent the voice of patients and the public," she said. This workshop was the first of its kind hosted in UM and UPM, and we hope it will serve as a strong model for a new style of community engagement in research in Malaysia. The event provided a platform for researchers and stakeholders to exchange ideas on how to facilitate research activities and better disseminate information.

"We are happy to be a part of this team because usually we are the ones who be the 'lab rat', being investigated in research, but now we have the opportunity to be involved as part of the research team", said Mr. Zainuddin Jambari, a member of the Patient and Public Involvement (PPI) group.

The team is planning to host more events and meetings to engage the PPI group and other stakeholders to help shape RESPIRE research to maximise relevance and opportunities for the research outputs to facilitate their integration into real-world practices.

HUMAN LUNGS

Smart Agriculture with Advanced LED Plant Tissue Culture Technology

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Micropropagation, known as plant tissue culture, plays an important role in the propagation of plants with desired characters in large quantities. Light is one of the most important variables affecting the growth and development of plant tissue cultures. The illumination system of lights for plant in vitro culture should supply light in the spectral region which is involved in photosynthesis and also in the photomorphogenic responses.



Artificial light sources including high pressure sodium lamps, fluorescent lights, and metal halide lamps have been used for a long time in plant tissue culture and growth rooms. However, these lights have a wide range of wavelengths, from 350 to 750 nm, which are redundant for promoting plant growth under in vitro conditions.

Light emitting diodes (LEDs) have been proposed as a primary light source for space-based plant research chambers and a potential substitute light source for in vitro plant growth and development to

attain success in commercial LED illumination. Different LED-generated spectra with uniform intensity are used in tissue culture of plants to improve plant growth, development, and proliferation. A continuous acquisition of new concepts and knowledge in the photobiology and morphogenesis, complemented with the rapid development of LED technology, will make the application of solidstate lighting more remunerative via in vitro plant propagation. It is reasonable to expect that LED irradiation systems with advanced semi-conductor materials, brighter intensity, and lower price will be the

major light sources for a wide range of micropropagation systems in the future. The development of an ideal lighting profile based on optimum lighting level, best lighting position, and illumination times in addition to energy savings is the main outcome of this project. Hence, the development of a Smart LED plant tissue culture technology system (SLT) using orchids, figs, and medicinal plants will be used as a model for the establishment of other important crops in Malaysia and South East Asia, especially for oil palm, banana and rubber.

Water Sans Micro-Pollutants

Zulkifli Yusop, Abdull Rahim Mohd Yusoff, Azmi Aris, Mohd Razman Salim, Jaafariah Jaafar, Zaiton Abdul Majid, Salmiati, Muhamad Ali Muhammad Yuzir, Tony Hadibarata | Universiti Teknologi Malaysia

There is a vital need to continuously improve water treatment plant performance in order to ensure consistent public health protection. This is made possible through an understanding of the underlying process mechanisms in the existing treatment plants. It is crucial to the treatment process that investigates how the existing treatment processes and practices can be further enhanced and optimized for maximum removal of micro-pollutants.

A study on Micro-Pollutants (NEPs), Investigation and Characterization in Water Source was carried out at Sg. Skudai, Johor. In this research, several NEPs were detected in the qualitative screening and their presence depends on the sampling stations and point sources of contamination. Their detection varies with seasonal changes and rainfall periods. As Sg. Skudai flows from plantation areas upstream through highly urbanized areas, the presence of NEPs is anticipated to come from various sources which include runoff from plantation areas, sewage treatment, plant effluvia, hospital waste, and sullage. The selected target pollutants are currently being studied for their fate and transformation products.

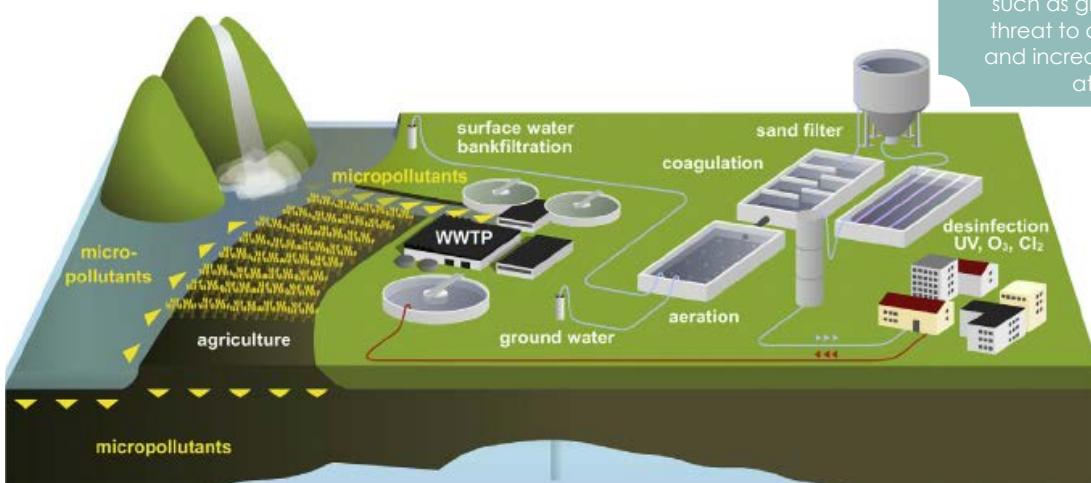
The study also involved the application of technologies of advanced oxidation processes (AOPs) in treating water containing NEPs. An electrochemical sensor containing a mercury meniscus modified silver solid amalgam electrode was developed to determine the drugs at ppb levels. An electro-oxidation technique using TiO₂/mixed metal oxides was also able to completely degrade Penicilline and Ampicilline. Apart from this, new carbon-based green sensors were also developed to determine the presence of five pesticides that are commonly used in plantations such as Paraquat, Metsulfuron-methyl, Lindane, Glyphosate, and Chlorothalonil.

All the newly developed sensors were applied to determine the respective NEPs in drinking, tap, and river water samples.

In addition, innovatively designed membranes (nanofiltration) in combination with ozonation to treat water containing NEPs were investigated. The application of SiO₂ nanoparticles embedded into PES matrices to improve the membrane performances has shown increased hydrophilicity, negative surface charged, and thermal and mechanical stability.

WHAT ARE THE DANGERS OF MICRO-POLLUTANTS?

The rising number of occurrences of micro-pollutants in water sources in many areas all over the world is indicative of an overall deterioration in water quality. An electrochemical sensor containing a mercury meniscus and a modified silver solid amalgam electrode was developed to determine the drugs at ppb levels. Micro-pollutants that are of interest in the water industry include natural organic matter (NOM), endocrine disrupting chemicals (EDC), antibiotics, polymers, pesticides, and other bioactive chemicals. While some of these chemicals are naturally present in the water, many are synthetics that are produced for human daily needs. The development of new drugs, for example, may save lives and cure certain diseases. However, not all drugs that are ingested are completely metabolized by the body as a certain percentage will be excreted through urine and will eventually make their way into the aquatic environment. Some of these drugs contain EDC, such as glucuronides, which pose a threat to aquatic organisms systems and increase the risk of cancer, even at nanogram levels.



1R+3r, Quadruple Helix, COMIC and MUSANG

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INTRODUCTION

Ever heard of 1R+3r? Quadruple Helix? COMIC and MUSANG? And more specifically, how these concepts are used in schools and education? This brief write-up will introduce these four concepts, which we would like to term as 'cohesion enablers', as well as provide examples of how these concepts have been adopted in school settings. This is part of the findings for our project titled 'Social Cohesion through the 1R+3r Concept in Malaysian Education System', funded by the Ministry of Higher Education under its long-term research grant scheme (code: LRGS/BU/2011/UKM/CMN/01).

1R+3r™ – WHAT IT STANDS FOR

The project's main theme is the role of education for social cohesion, with particular emphasis on promoting the 1R+3r concept as an important 'cohesion enabler' in education. 1R stands for 'Relationship' while 3r is a reference to the abilities to 'recognize, respect and reconcile'. Social interaction among students from different backgrounds will enable them to learn about themselves and others, thereby creating opportunities for the establishment of meaningful relationships (1R) based on knowledge (recognition), trust (respect), and acceptance (reconciliation). The question to be asked is: in view of the availability of different school systems, or 'different routes', in Malaysia, how then can we create spaces and opportunities for the 1R+3r cohesion enabler to flourish in the hearts and minds of the students?

II) QUADRUPLE HELIX – ACTIVE PARTNERSHIP

The school is but one institution existing in a complex system of inter-related institutions within particular contexts and conditions. The evolution and sustainable development of the school depends on a variety of factors. One such factor that plays a significant contributory role is the presence of active partnerships between the school and main actors in its vicinity, such as parents and family, neighbourhood and community members, the private sector, and the NGOs. The cooperation and networking among these principal sectors - school, family, community, and the private sector - is another 'cohesion enabler' wherein individuals from different segments of society come together to contribute their respective talents, experiences, skills, and resources for the betterment and development of the school (see Figure 1).

III) COMIC & MUSANG

COMIC and MUSANG – these are two concepts introduced by a school in the remote highlands of Sarawak. Faced with a lack of resources and parental support, the school leadership adopted a community-based approach in encouraging the community to regard the school and its well-being as part of their collective responsibility. The COMIC and MUSANG programmes saw the actualisation of the Quadruple Helix and 1R+3r concept. COMIC is the acronym for Community in the Classroom and MUSANG means the ability to work together under the most difficult circumstances. With COMIC and MUSANG in action, the school is now regarded as 'OURS' and not merely the sole responsibility of teachers and the headmaster. Under COMIC, each classroom was adopted by 2-3 villages, which would then be responsible for the upkeep, cleanliness, and well-being of the classroom. Under MUSANG, members of the community came together to discuss, deliberate, and distribute tasks to solve whatever difficulties their school was facing. These COMIC and MUSANG programmes served as the 3rd cohesion enabler in bringing people of diverse interests and skills together to achieve a common and collective goal.



school

Parents

Community

Private Sector

Remarkable R.O.S.E

(Removing Obstacles to Cervical Screening)

PROF. DR. WOO YIN LING

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY,

FACULTY OF MEDICINE, UNIVERSITY OF MALAYA

Project ROSE is a comprehensive cervical screening program that employs a human-centered approach in developing a solution while integrating the latest advances in screening and information and communication technology (ICT).

Cervical cancer is one of the top three most common cancers in Malaysian women. Cervical cancer is one of the most preventable and treatable forms of cancer as long as it is prevented with HPV vaccination, detected early, and managed effectively. However, the uptake of Pap smears in Malaysia is low despite campaigns and accessible healthcare facilities.

Project ROSE, a novel cervical screening program employing self-sampling, HPV DNA testing and digital technology, led by

the University of Malaya and VCS Foundation in partnership with the Ministry of Health of Malaysia, Cancer Research Malaysia, Celcom Sdn Bhd, George Washington University, and Cepheid, is a paradigm shift from conventional cervical screening programs. Its uniqueness is the application of design thinking principles in the development of a prototype solution for Malaysia and potentially other countries where population-based organized screening remains a challenge.

The 'human centered approach' towards cervical screening adopted by Project ROSE includes a combination of (i) self-sampling by women instead of a physician acquired specimen requiring an uncomfortable pelvic examination; (ii) the adaption and implementation of registry support; and (iii) communication by mobile

technology, thus efficiently tracking women along the screening pathway, in real time, to enable real time, real world program monitoring. It is anticipated that with an HPV positivity rate of 5-8%, i.e. 92-95% of woman screened who tested negative would not need further testing for the next 10 years.

The Project is a true multilateral partnership that links universities, the government, NGOs, and for-profit companies to support cancer prevention in Malaysia. This collaboration is an example of health system strengthening which can take place within the wider context of international relationships. Co-development and mutual contribution, rather than one-way knowledge transfer, has resulted in the 'ROSE intervention' within the Malaysian context.

ADVANCING THE STATE OF THE ART OF MIMO (ATOM): The Key to Successful Evolution of Wireless Networks

PROF. MADYA. IR. DR. ADUWATI SALI (UPM) & DR. BRUCE LEOW CHEE YEN (UTM) UNIVERSITI PUTRA MALAYSIA & UNIVERSITI TECHNOLOGY MALAYSIA

This project is funded by the EU under the Horizon2020 initiative: SCA-RISE-2015 - Marie Skłodowska-Curie Research and Innovation Staff Exchange (RISE) (1/2/2016 – 31/1/2020) with a project amount of €904,500.00 and an allocation to UPM: €139,500.00 ~ RM622,170.00. The project supports mobility between project partners. Several research attachments between UPM, UTM and EU Universities (i.e. University of Lancaster, University of York, and University of Cyprus) began in 2016 and will end in 2019.

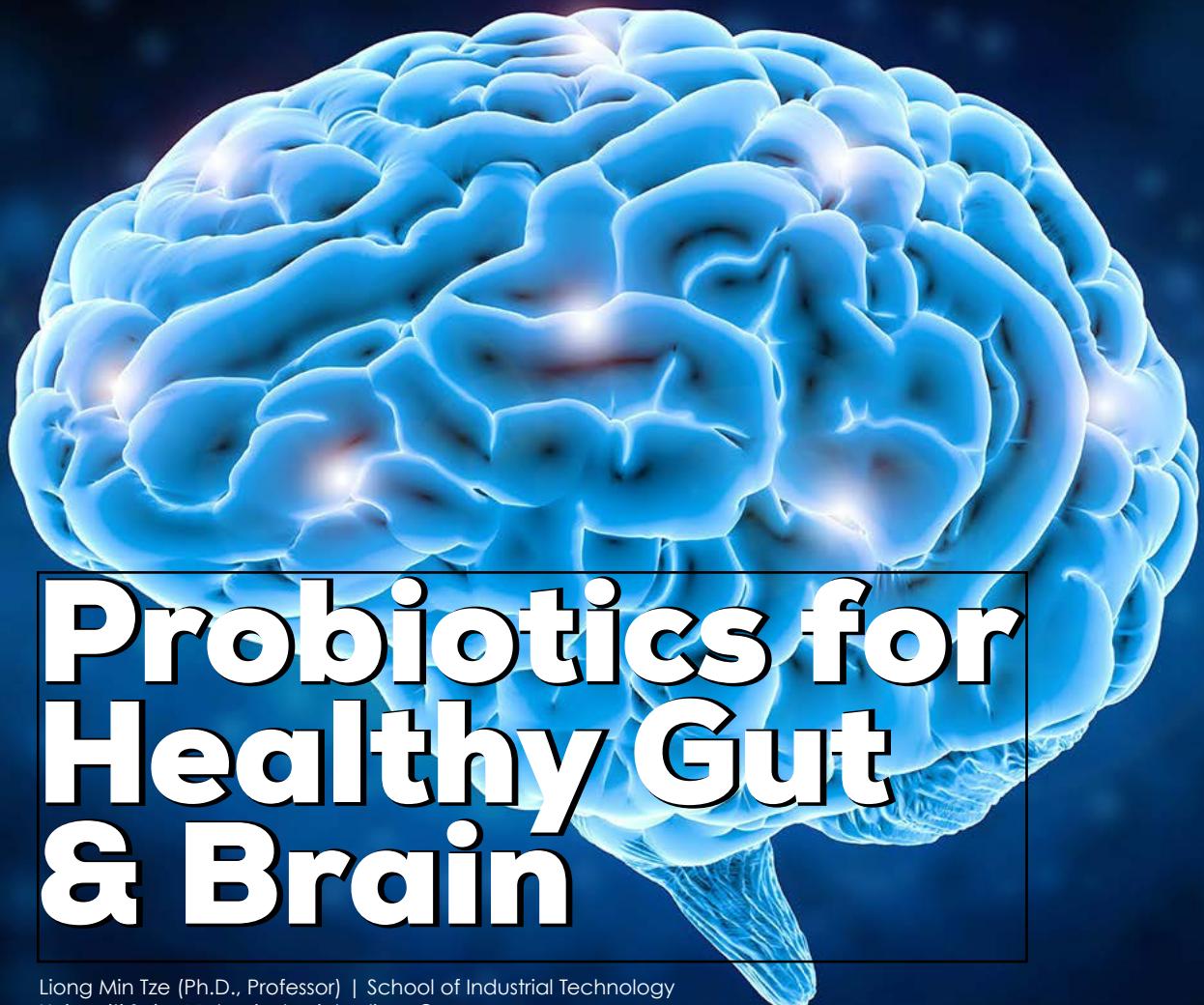
It is a global phenomenon that the world is experiencing an increase in wireless broadband usage where global wireless data traffic is expected to grow at an annual rate of 78%. Multiple-input multiple-output (MIMO) technologies have been envisioned as a key to the successful deployment of next generation

networks, which are challenged by many practical constraints such as spectrum scarcity and dynamic wireless environments.

The ATOM project sets a research agenda to fully exploit the potentials of MIMO technologies for revolutionizing wireless networks. In particular, the overall objective of ATOM is to accelerate the transfer and deployment of research knowledge between European countries and third-country partners in order to provide a framework for advanced MIMO solutions for realizing green, secure, and high data throughput wireless communications. The novelty of this project is four-fold. Firstly, the project brings together two advanced MIMO technologies, massive MIMO and cloud radio access networks (C-RAN), where a novel heterogeneous network architecture is proposed to boost

network capacity by effectively exploiting the advantages of massive MIMO and C-RAN. Secondly, a rigorous algorithm-theoretic framework for maximizing energy efficiency is developed for the proposed heterogeneous architecture, whereby energy harvesting is realized by applying the novel concept of simultaneous wireless information and power transfer (SWIPT). Thirdly, dynamic physical layer conditions in wireless environments are used to develop comprehensive security solutions for implementing keyless secure transmissions as well as key establishment, which will bridge the gap between physical layer security and conventional cryptography. Finally, we will extend the existing wireless network testbed available at the consortium and carry out experimental evaluations for closing the gap between theory and practice.





Probiotics for Healthy Gut & Brain

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Probiotics are friendly bacteria that are beneficial to health and are commonly found in fermented foods such as yoghurt, cheese, kimchi, tempoyak, and salami. Historically, probiotics are eaten to ease gut diseases. Over the years, new research has found various other health benefits of probiotic bacteria including lowering of cholesterol, antihypertensive effects, easing menopausal symptoms in women, and treating skin diseases.

It has been ascertained that probiotics have their own identity, characteristics, and "temper", just like humans! Thus, not all probiotics are the same. At USM, my research focuses on "talent sourcing" of

probiotics and identifying their health potentials. My interest for the past 5 years involved the use of probiotics for brain health. We started with feeding probiotics to mutant fruit flies. These mutant fruit flies had Alzheimer's Disease (AD) and the presence of AD is shown in the abnormal development of their eyes (such as loss of hexagonal-shaped features, loss of hair-like features, and formation of holes).

Some probiotics prevented the development of AD in these mutant fruit flies, as seen in the development of more normal eyes. We then fed probiotics to rats that were aged. As we all know, aging causes brain degeneration and often leads to

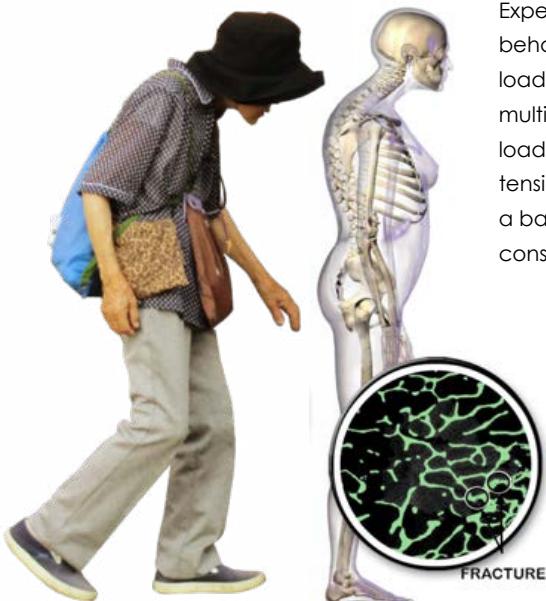
stress, anxiety, loss of memory, and cognitive functions. Some probiotics prevented brain degeneration in aged rats, leading to better memory and cognition.

Finally, we have provided these probiotics to people with high stress levels. Upon eating the probiotics for 12-weeks, stress levels were decreased. In addition, brain "happy chemicals" were also increased, blood inflammation decreased, memory and cognitive functions were also improved. Taken altogether, this project successfully shows that probiotics that reached the gut, could benefit the brain, via the "gut-brain-axis".

Special Coating Induces Bone Generation

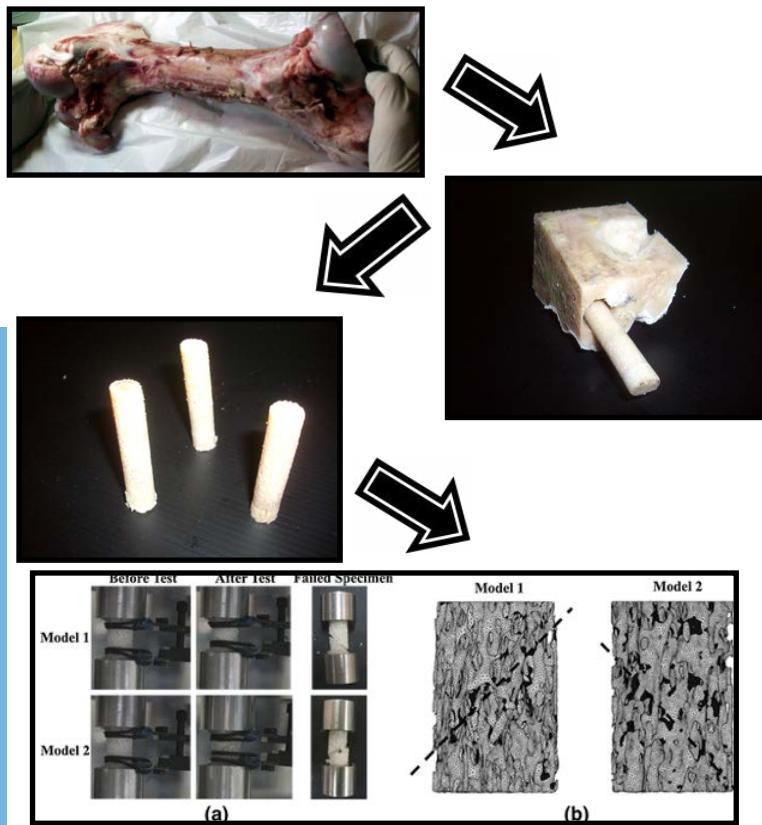
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Bone fatigue can occur in physiological conditions, even in the absence of bone-related pathological conditions. The last few decades attest to increasing interests in the fatigue behaviour of bone. Fatigue fractures in the elderly population are associated with bone changes with increasing age. With the ongoing increase in lifespan, it becomes more important to understand bone properties, thus increasing the importance of fatigue evaluation. As fatigue fracture can take place in both the cortical and the trabecular bone during prolonged exercise in healthy adults (known as stress fractures) and in elderly patients with osteoporosis, the accumulation of microcracks, permanent strain and strength reduction can gradually occur with increasing cycles of loading during ambulatory activities.



Our team studied the effects of three different load histories from physiological loading that is applied on the trabecular bone in order to predict the first failure surface and the fatigue lifetime. The fatigue behavior of the trabecular bone under uniaxial load was compared to that of multiaxial load using a finite element simulation. The plastic strain was found localized at the trabecular structure under multiaxial load. On average, applying multiaxial loads have reduced more than five times the fatigue life of the trabecular bone. The results provide strong evidence that multiaxial loading is dominated in the low cycle fatigue in contrast to the uniaxial one.

Experimental and computational studies have sought to characterize fatigue behaviour and failure of the trabecular bone mostly under uniaxial compressive loading. However, in regular daily activities, the whole bone is loaded with multiaxial stress states apart from multidirectional functional and abnormal loading from physiological trauma. Thus, the combination of axial compression-tension and torsion-shear imposed on the fatigue evaluation may produce a basis for bone fatigue due to post trabecular bone failure with many consequences during normal gait adaptation.



INTEGRATED SMART CITY/SMART VILLAGE APPLICATION TO SUSTAIN AN INNOVATIVE DIGITAL ECONOMY

HEADED BY PROF. DATO' DR. HALIMAH BADIOZE ZAMAN et al.
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The Integrated Smart City/Smart Village Neighborhood (ISC/SVN) framework was based on two main dimensions: (1) human capital, with specific reference to the elderly; and (2) the environment, which includes elements such as security, cleanliness, and health respectively.

The findings of the analysis of a knowledge or digital society in Malaysia indicated that the most important dimensions were human capital and the environment. The latter comprises elements such as security, cleanliness, and health. These elements were used to build the following tools for a smart home in a secure and clean, smart neighborhood that is part of either a smart city or a smart village with some adjustments made for the smart village: the video surveillance visualization system and JagaBOT™; the intelligent waste monitoring system; and the Wearable Elderly Electronic Handling & Emergency Response Application (W-Emas™).

The intelligent patrol robot system for real time comprehensive surveillance of the smart home and offices in the smart city would ensure a safe and secure environment. The system, called the JagaBOT™ comprises three main modules: (i) the physical JagaBOT™ itself; (ii) the JagaBOT™ operation and control system; and (iii) the server system. This system is innovatively unique as it can execute dynamic on-site inspection and mitigation actions upon

detection of an anomalous event.

The intelligent waste monitoring system is based on the Wireless Sensor Networks (WSN) that is built on a three-level architecture consisting of a smart bin, gateway, and control station. All the sensors are integrated on a sensor board that is connected to the Waspmove sensor platform.

The Wearable Elderly Electronic Handling & Emergency Response Application (W-Emas™) for a smart home in the smart city/smart village environment allows the elderly to lead a more secure and safe life. The W-Emas™ can also help the elderly call emergency first responders as well as children or friends in the event of sudden illness via this wearable device.

FUTURE WORK

Future projections include ensuring that these prototypes are practically implemented in real, newly constructed smart homes in a smart city/ smart village. The institute is working with MIGHT and a company called Sistem Perintis in anticipation of collaborative projects that can be implemented in newly designed smart neighborhoods in Malacca, Putrajaya, and Selangor.

Fun Halal Discovery for Children



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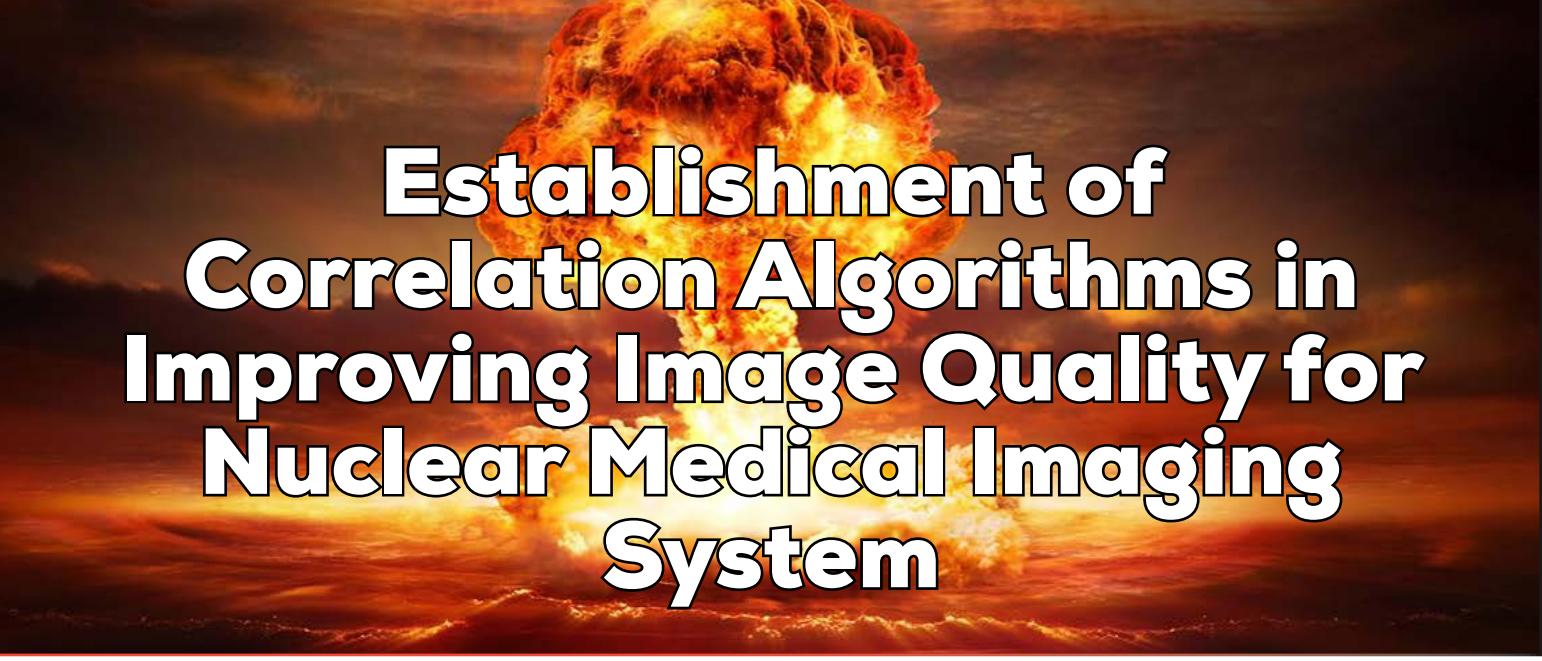
Explaining the concept of halal might not be difficult to grown-ups, but it is a different situation when it involves children. The young ones usually have hundreds of questions when it comes to understanding the concept of 'halal'. Some parents might even find it difficult to explain such a concept to their children.

In conjunction with the government's initiatives to be at the forefront of the halal industry, the University of Malaya has established a center known as the University of Malaya Halal Research Center (UMHRC) dedicated not only to conducting halal-related research per se but also to providing halal services and training to the

halal industry, locally and globally. While this Center has always been very active in spreading halal knowledge amongst university students and the public, it could not help but notice the necessity to disseminate halal knowledge among young children.

The first ever program entitled 'Genius Muslim Project: Fun Halal Discoveries' was organized during the school holidays on December 12, 2018, involving 47 children between 5-12 years of age. This program was organised in collaboration with the Halal Industry Development Corporation (HDC), an agency that coordinates the overall development of the halal industry in Malaysia.

There were six activities that were conducted during the program such as Halal Understanding Talk by HDC, treasure hunt activities, recognizing halal logo activities, and halal games. These children learnt that halal food is not only good for Muslims but also for everyone else as halal also connotes safety and quality. They finally walked out of the room with an improved grasp of halal basic knowledge, the ability to recognize halal logos, and an understanding of why halal needs to be incorporated in their daily lives. Most importantly, they really had fun!



Establishment of Correlation Algorithms in Improving Image Quality for Nuclear Medical Imaging System

ALGORITHMS FOR BETTER QUALITY NUCLEAR IMAGES

A scintillation camera, also known as a gamma camera, is widely utilized in aiding medical personnel in performing patient diagnostics and analyses. The scintillation camera was first developed by Hal Anger in 1957. The camera consists of a collimator, crystal, and a photo sensor such as the PMT (Photo Multiplier Tube). In addition to this, electronic circuitry is also required to perform the amplification and related measurements.

Recent research on light photon detection has resulted in the introduction of the Silicone Photomultiplier (SiPM) which operates at a low voltage and is insensitive to magnetic fields. Generally, the SiPM is potentially capable of replacing the PMT with a Gamma camera although several elements of the SiPM require some deliberation. A single pixel of an SiPM can be as small as 1mm^2 . Hence, it is potentially feasible to construct a mobile gamma camera machine that is both small and portable.

The research team used an SiPM sensor with 16 pixels (4×4) to collect light photon readings. Each pixel is a square type device sized $3\text{mm} \times 3\text{mm}$. Detailed specifications of the sensor are shown in Table 1. Next, a radioactive source, Cs-137 as specified in Table 2, is used as the gamma emitter device. The researchers also implemented the use of scintillation material to convert the gamma ray photons to low visible light. The gamma ray photons were scintillated using 6.35mm scintillation

Table 1: SiPM Sensor Specification

ITEM	Description
SiPM Model	SensL Array SL4-30035
Peak wavelength	500nm
No. of channels	16 channel (4×4 pixels)
Pixel area	$3.16 \times 3.16 \text{ mm}^2$
Pixel active area	$3.05 \times 3.05 \text{ mm}^2$
No. of microcells	4774 microcells/pixel

Table 2: Gamma Ray Emitter Device

ITEM	Description
Radiation type	Caesium-137 (Cs-137) 500nm
Half life	30.2 years
Gamma ray energy	661.6 keV
Activity/ Dps	$1.0 \mu\text{Curie}$ (3.7×10^4 Dps)
Year of Manufacture	2007

Table 3: Scintillation Material Specification

ITEM	Description
Crystal type	CsI (Tl) Cesium Iodide (Thallium Activated)
Peak wavelength	550 nm
Thickness	6.35 mm
Light yield	54 photons/keV

material CsI(Tl), the specifications of which are available in Table 3. The overall research experiment setup is provided in Figure 1.

The imaging experiment began with the configuration of the sensor and electronics acquisition device. Next, using the appropriate HV biasing value, the sensor was exposed to the radioactive source for 60 seconds from a distance of 1cm. The process was repeated 360 times to simulate a SPECT system performing a 360-degree motion with

respect to the radioactive source. For each angle during the rotation of the sensor, a Radon transform was performed, and these were then cumulatively combined to produce a Sinogram. Finally, an Inverse Radon transform was carried out to reconstruct the image. Several pre-processing techniques and filters were applied during the analysis. The reconstructed image was evaluated by determining the contrast ratio to ascertain the optimum technique for image reconstruction

Figure 1: Research Experimental Setup

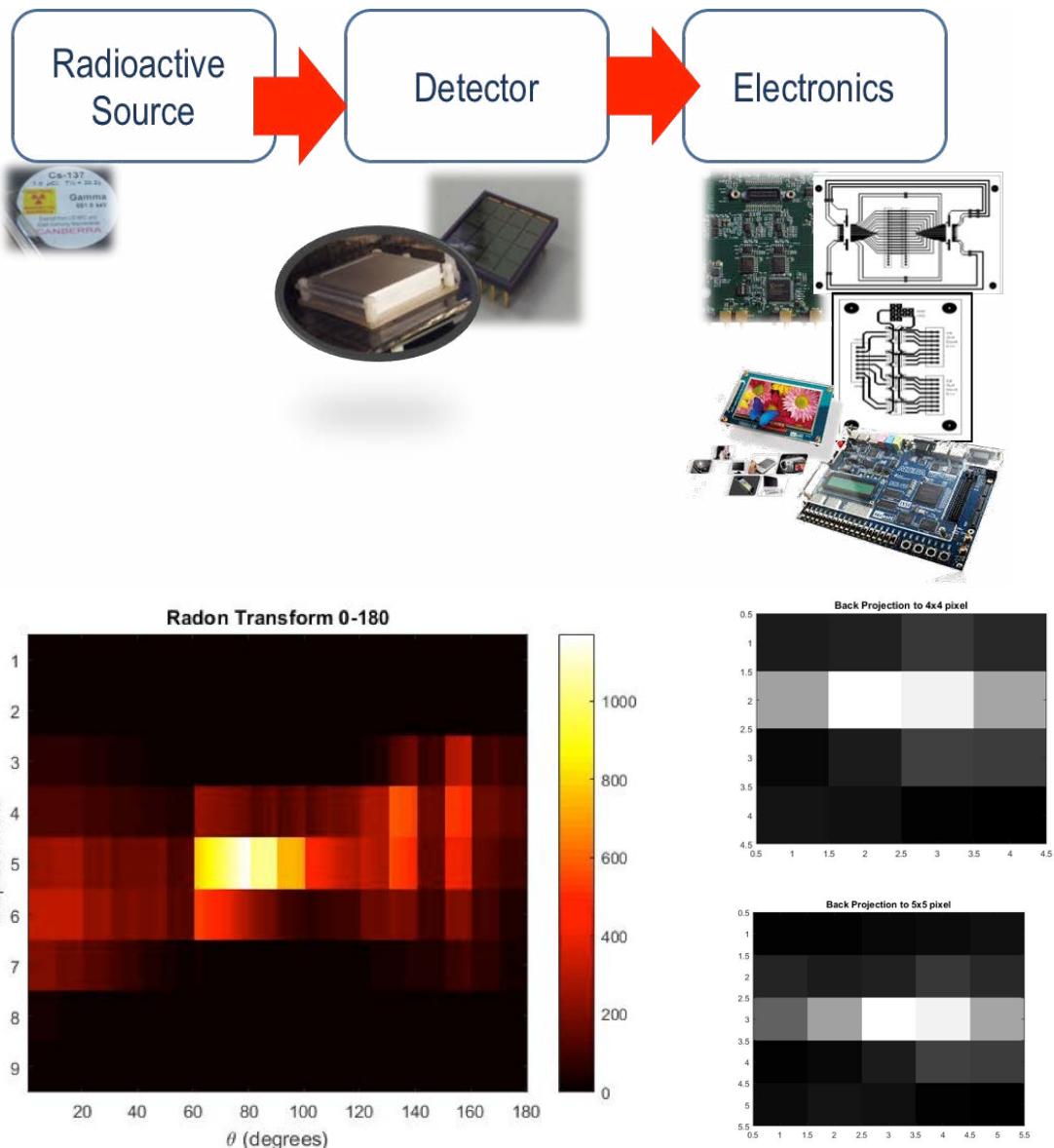


Figure 1: Research Experimental Setup

LIGNO-X COOLANT: ANTI-CORROSION COOLANT FROM OIL PALM BIOMASS

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The conversion process of biomass waste has garnered great interest among researchers who recognize its potential as a viable alternative raw material in shifting from oil-based products to the production of bio-based chemicals and various products. Since lignocellulosic biomass from palm oil activities is deemed to be the best resource of renewable energy and chemical applications due to it being sufficiently available at very low cost, and relatively environmentally safe, a proper exploitation to convert lignocellulosic biomass into various useful products will minimize waste.

Among all biomass components, lignin has gained much attention due to its unique properties as well as its desirable applications. Lignin which is non-toxic, complex, and a natural phenolic polymer that contains various reactive chemical reaction sites such as hydroxyl, methoxyl, carbonyl and carboxyl functional groups, has become increasingly important in many industrial applications. Since metals and alloys are important materials that are widely used in industrial applications, one of the most efficient ways to protect them against corrosion is by employing a corrosion inhibitor.

In the recent invention, we have developed a product named LIGNO-X COOLANT and the good thing about this product is it was formulated using lignin from oil palm biomass (less toxic than chromates and phosphates) as its active ingredient for corrosion inhibition. It can reduce both the corrosion rate and

reduce the aggressiveness of the environment by providing a more green protection to the metal surfaces such as in reaction vessels, pipes, machinery, batteries, and vehicles (car body and radiator). Recent field tests with Excel Rim (M) Sdn. Bhd. have proved that LIGNO-X COOLANT shows better properties in reducing metallic corrosion to that of commercial brands.



Green Growth in Malaysia

Nanthakumar Loganathan, Asan Ali Golam Hassan, Abbas Mardani & Lekha Laxman Kunju Pillai

A large percentage of the population in most developing and emerging countries is directly dependent on natural resources. The last three decades have seen the idea of a 'green economy' which floats out of its moorings in environmental economics into the mainstream of policy discourse. Without a doubt, the recent traction of the concept of a green economy has been aided by the widespread disillusionment with the prevailing economic paradigm, a sense of fatigue emanating from the many concurrent crises and by recent market failures.

The first issue is the increasing evidence of a way forward in the new economic paradigm in which material wealth is not delivered perforce at the expense of growing environmental risks, ecological scarcities, and social disparities.



A green economy can take advantage of new growth trajectories designed to be more socially inclusive as well as responsive to poverty reduction and economic diversification objectives.



Produce goods and services to measure, prevent, limit, minimize, or correct environmental damage to water, air, and soil as well as problems related to waste, noise, and eco-systems. These include cleaner technologies, products, and services that reduce environmental risk and minimize pollution and resource use.



Promotes quality and eco-efficiency of economic growth as well as environmental sustainability performance as the principles for greening growth with (i) an eco-tax reform, (ii) sustainable infrastructure, (iii) greening of business, and (iv) sustainable consumption as the four pillars for the transition to a greener growth.

Bioeconomy Policies around the World



The National Green Technology Policy (2009) in Malaysia is aimed at establishing the green economic development for Malaysia for a long-term period. The government also provides a conductive environment to greening the economy by taking into account the economy, and social and environment indicators.



What Happens to Malaysia as the World Gets Warmer?

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Malaysia has been impacted by climate change and will be impacted more as climate temperature continues to rise. According to the United Nations Inter-governmental Panel on Climate Change (IPCC), the current level of CO₂ concentration in the atmosphere has exceeded 400 ppm, which is far beyond the range of the natural fluctuations of CO₂ since almost a million years ago.

Due to this, the Earth climate system has accumulated additional heat since at least circa 1970 causing the global mean temperature to increase 1°C above pre-industrial levels. Without substantial mitigation, the global average temperature

is projected to increase 4-5°C higher than the pre-industrial level by the end of the 21st century. Warming of that level would have catastrophic impacts on the environment, ecosystems, food productions, critical sectors, and human civilizations.

Despite the establishment of the Paris Agreement, an international treaty to cap global warming at 2°C, many studies showed that the likelihood for such a target to be achieved is only 5%. How will Malaysia be impacted if the world fails to reduce GHG emission? Here we investigate the drought conditions in Malaysia when the global mean temperature reaches 2°C and 4°C. Operating within a business-as-usual emission scenario, these levels of warming

are projected to occur in 2041 and 2083, respectively.

Using multi-model regional climate simulations, we showed that Malaysia is projected to experience increased dryness, as indicated by the consecutive dry day (CDD) index under global warming of 2°C and 4°C. For example, Peninsular Malaysia and Sarawak are projected to experience a 30-50% increase in CDD if global temperature increases by 4°C. Such levels of dryness are experienced only in the extremes of El Niño in the current climate. More seriously, a combined effect of El Niño and climate change would be catastrophic for Malaysia in the future if the world fails to mitigate climate change.

"Catastrophic For Malaysia In The Future If The World Fails To Mitigate Climate Change".

PROPHETIC FOOD FOR THE SOUL

Zulkifli Mohd Yusof^{1,6}, Khalijah Awang^{2,7}, Rozana Othman^{3,7}, Khadher Ahmad¹, Mohd Rais Mustafa^{4,7}, Munirah Abd Razzaq¹, Mohd Asmadi Bin Yakob⁸, Nurulwahidah Fauzi⁹, Najihah Mohd Hashim^{3,7}, Leong Kok Hoong^{3,7} & Puteri Shafinaz Abdul Rahman^{4,7}

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Medicinal plants have been employed in treating ailments for centuries. The Quran and Hadith are important sources of reference as they provide information about the usage of various plants and their medicinal properties. Scientific studies on these plants are important in unfolding the wisdom delivered by Allah.

Most plants in the Quran and Hadith are well known and a variety of local products have been formulated based on these fruits and herbs.

The current study focuses on six plants: henna, camphor tree, jujube, basil, shampoo ginger (lempoyang), and pomegranate. These local plants are chosen for further scientific studies to enable future product development. Our investigations have shown that both the camphor tree and jujube possess antimicrobial, antidiabetic, and anticancer (against breast cancer) properties, with the camphor tree having additional anticorrosive effects. Pomegranate and henna showed potential antidiabetic activities. Additionally, henna demonstrated potential as an antiulcer agent with gastroprotective effects whilst the lempoyang showed potential for the management of dengue-related illnesses.

The demand for these "sunnah" food products is ideally tempered with the need for proper preparative steps according to the practice of Sunnah and Al-Quran. Doubts may arise due to modifications in generating these products by the present

society because in Prophetic Sunnah, the mixing of certain plants for consumption is unhealthy and prohibited. Attempts in clarifying this information are made in the present study to resolve issues related to the health benefits of these foods (that are produced in abundance) with the correct consumption techniques according to the Sunnah. This study will assist in correcting the misunderstandings of the ethnomedicinal usage of these plants. A book titled "*Tumbuhan dan Herba Dalam Perspektif Ilmu Wahyu dan Sains*" is currently in progress.

On the whole, the project has revealed more scientific data for the selected plants in ethnomedicine. These findings may lead to the development of pharmaceuticals, neutraceuticals, and cosmeceuticals with proper usage in accordance with Al-Quran and Hadith. The knowledge and benefits gained may include economic enhancement and providing Barakah and prosperity to society.





MALAYSIAN TUALANG HONEY AS AN ANTI-ANGIOGENIC AGENT

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Angiogenesis, the growth of new blood vessels from the pre-existing blood vessels is important in wound healing and reproduction. It mainly involves vascular endothelial cells proliferation, migration, differentiation, and organization. However, angiogenesis in pathological conditions, such as cancer, plays an important role in tumor growth as well as metastasis by providing nutrients to the tumor cells.

Conventional chemotherapy is usually a systemic therapy that tries to capture a narrow therapeutic window offered by rapid proliferation of tumour cells compared to the normal cells. However, it causes significant side effects such as hair loss, diarrhea, mouth ulcers, immune suppression, and infection. Apart from that, cancer cells resistance to drugs has also been reported.

Anti-angiogenic therapy has several advantages over chemotherapy as it is mostly not directed towards

directly killing cells but stopping blood vessel formation, an event that is rare in tissues other than growing tumors. By inhibiting angiogenesis, oxygen and nutrient supply to the tumor will be stopped. On top of that, it is well tolerated by the patients, has fewer side effects, and can prolong the lives of cancer patients. Hence, anti-angiogenesis may prove a promising anti-cancer strategy in therapeutic development.

To date, there are currently only thirteen approved anti-cancer therapies with recognized anti-angiogenic properties in oncology in the US, despite challenges with low efficacy and development of drug resistance after long-term consumption. Thus, there is a need to seek a more potent anti-angiogenic regimen to improve the overall survival rate of cancer patients.

We have shown that Malaysian Tualang Honey (MTH) inhibited inflammation-induced vascular

hyperpermeability, a required event for angiogenesis in the previous project. By having shown MTH to affect this relatively 'early' event, we are now focusing on determining the anti-angiogenic effect of MTH through various approaches, in addition to unveiling the underlying mechanism. The anti-angiogenic properties of MTH was confirmed via *in vitro*, *ex-vivo*, and *in vivo* settings. Human umbilical vein endothelial cell (HUVEC) was used in the *in vitro* setting; it is not only a good representative of vascular endothelial cells *in vivo*, but it is also easily harvested from large blood vessels. Additionally, endothelial cells, in contrast to cancerous cells, are genetically stable as they do not undergo mutations and thus are more sensitive to the apoptosis effects of the cytotoxic agents. Therefore, these features of endothelial cells make them a convincing target for anti-angiogenic treatment.

MALAYSIA'S FUTURE HIGHER EDUCATION SCENARIOS:

FOURTH INDUSTRIAL REVOLUTION AND BEYOND

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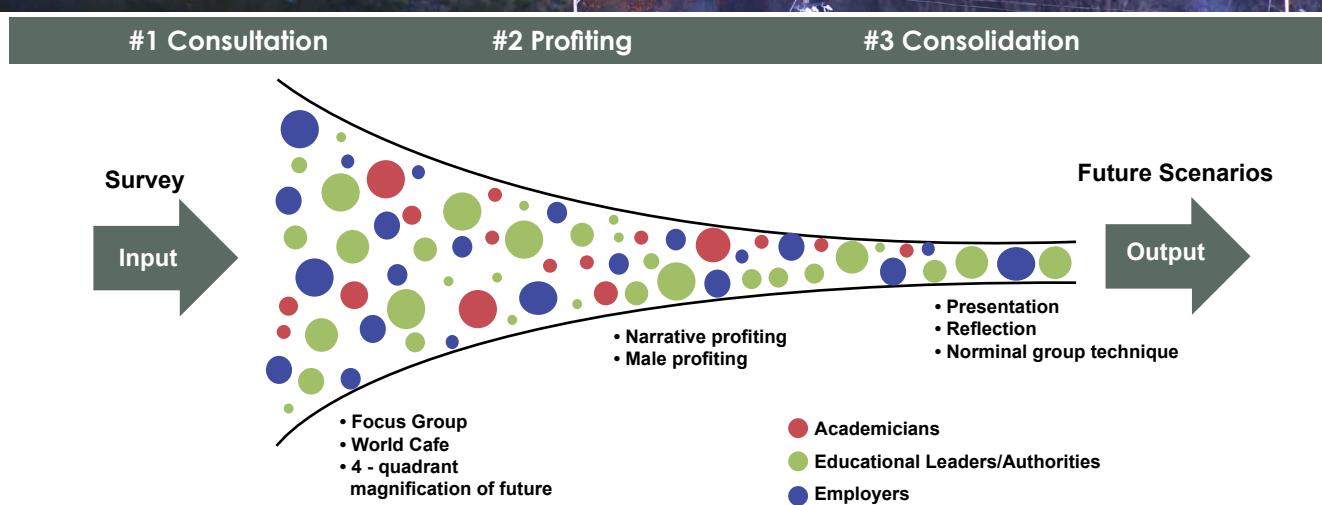
Higher education is highly needed, but a declining trend in the relevance of conventional higher education institutions puts it at risk in the future. The future is full of uncertainty, is volatile, complex, and ambiguous. While it might be almost impossible to predict the future of higher education, it is however possible to build futures based on scenarios. The aim of this study is to construct Malaysia's higher education future scenarios in a challenging and changing world. A foresight lab was conducted based on the scenario planning methodology and 48 stakeholders (10 policy-makers, 4 employers, 20 educational leaders, and 14 academics) were engaged to construct future scenarios. The core areas that were discussed included humanising learning

institutions, leveraging uberisation for betterment of education, revitalising education ecosystems, and strategizing education for a changing world towards harmonizing human-technology interfaces.

Four future scenarios were constructed that include Humaniversity, Uberniversity, Utilitarian, and Adaptive. The stakeholders think the top two most workable scenarios to work with are Adaptive and Uberniversity, although the ideal scenario is Humaniversity.

Based on the scenarios and premise of human-technology relations, technology-enhanced education, values-driven education, and sustainable education, 12 strategic action areas with 45 key initiatives were proposed to serve as a guide

for policy-makers, education specialists and higher education sectors to move towards the future. The proposed strategies and initiatives are the essential steps that could be undertaken collaboratively to create a conducive environment for shaping the future of higher education in Malaysia. The primary focus in scenario planning is on learning, and not on any particular forecast. The research team believes that continuous monitoring and challenging used future scenarios are essential in capturing uncertainty to allow for creative thinking towards the best state of desired futures. The vision is to enhance the capacity of delivery (enables) and bring out the best in people (ennobles) to chart strategies for delivering the best.



SUPER 5G ANTENNA TECHNOLOGY

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In our present life, a mobile phone or a smart phone has become indispensable. The mobile phone service started in the 1980s and has been improving every 10 years (Figure 1). Now, the fourth generation service (4G) is in operation. The further improved service, namely 5G, is still in the developing stage.

In 5G service, users are not limited to the phone only in that everything else such as home equipment or machines can become users. In almost all communications, the internet is used and this service is called Internet of Things (IoT). Therefore, a large number of users, that is ten times the number of 4G users, need to be catered for. Moreover, connection time between users is requested to be very quick (almost 1 millisecond) that is one tenth of 4G. In order to achieve 5G system, many technologies such as network, communication, and related radio wave need to be developed. As for radio wave technology, milli-meter wave usage and base station antenna are important.

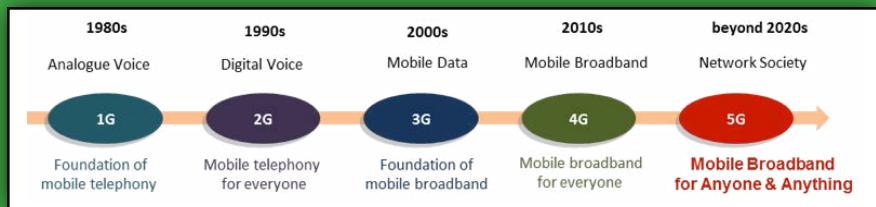


Figure 1. Evolution of mobile phone system

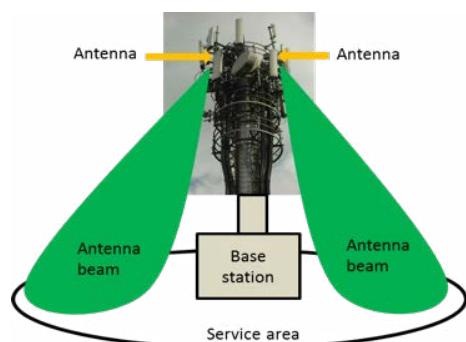


Figure 2. Base station antenna for 4G

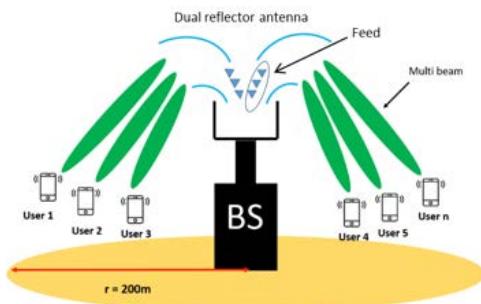


Figure 3. Base station antenna for 5G

For the 4G system, the service area is covered by a very wide antenna beam (Figure 2) at a frequency of 2 GHz. Base station antennas are installed at the top of a tall antenna tower. Many users are contained in this wide beam. For the 5G system, one antenna beam is assigned to one user (Figure 3) at milli-meter frequency so as to increase user numbers. At milli-meter frequency, antenna sizes are reduced to one tenth of a centimetre for ease of handling. So, many antenna configurations are now developing.

One promising configuration is a reflector type antenna (Figure 3). The antenna comprises reflectors and feeds. By arranging many feeds, many beams (multi beams) can easily be achieved. Antenna structure seems to be suitable for tower top installation. By employing a dual reflector configuration, all multi beam shapes can be improved through reflector shaping technology.

IMPACT AND CRITICAL SUCCESS FACTORS FOR INNOVATIVE DIGITAL ECONOMY

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It is crucial for critical success factors (CSF) to be considered carefully for an innovative digital economy to be achieved. This includes identifying socio-cultural and socio-economic needs in relation to their impacts on increased digital adoption and participation, in promoting digital inclusion and acculturation in the society.

The project was implemented between 2012-2015 and a nationwide survey was carried out on 4500 participants who were selected based on a stratified sampling technique across the population ratio of the main ethnic groups in Malaysia. Another set of 314 respondents representing population from the SME sectors were also surveyed and interviewed.

Both descriptive as well as inferential analysis were applied to analyse the data. In sum, the study empirically revealed the population's differentiated ICT trends in terms of level of awareness, relevance, access, acceptance, satisfaction, ownership, and value of current and proposed technologies and applications.

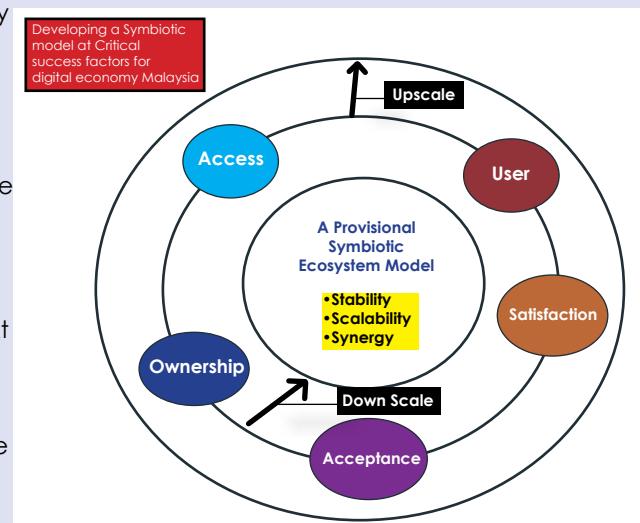
At the micro level, five main CSFs (a) user, (b) access, (c) ownership, (d) satisfaction, and (e) acceptance and their related indicators were found to be significant indicators that contribute actively in the digital economy. Whereas at the macro-level, the findings illustrated the asymmetrical state of digital maturity of the current population, the extent of digital diffusion, and e-inclusiveness in the country.

A useful output generated from this project is the development of a symbiotic model of CSF which depicts how the asymmetrical ecosystem of CSF indicators can achieve stability by providing systemic solutions through the scalability and/or synergy of the related critical factors that represent user digital needs and maturity. At the same time the symbiotic ecosystem model could be used to gauge the potential

effectiveness of future proposed applications, and to postulate criterions for an efficient diffusion of innovation strategy for their sustainable usage, as well as guide proposed initiatives and policies for enhancing innovative digital economy in Malaysia.

ACKNOWLEDGEMENT:

This study was made possible by the Ministry of Education translational research grant - LRGS/TD/2011/UKM/ICT/05. Research team members included -- Ali Salman (UKM), Norizan Abdul Razak (UKM), Supyan Hussin (UKM), Mohd Safar Hasim (UKM), Musa Abu Hassan (USIM), Rozhan Idrus (USM), Samsinar Md Sidin (UPM).



SING & MOVE, ACT & PLAY: BUILDING YOUNG CHILDREN THROUGH PERFORMING ARTS EDUCATION

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One of the fundamental issues that is frequently highlighted in educational discourses is the emphasis on the importance of emotional intelligence, with a special regard to nurturing a creative mind using the imagination as children make their journey through school, to become well rounded adults. Besides allowing children to develop creative passions, performing arts encourages the development of language and oral skills, thus enabling them to communicate more effectively and confidently. Music and drama, for example, provide opportunities for different means of creative expression via singing, musical sound, imaginative

storying, acting, playing, and movement and gesture in a broader context.

Together with 80 primary school children of SK Pekan Ranau, Sabah, we conducted a series of music and drama activities based on the national educational syllabus. The activities consisted of body-movement teaching, interactive theatre lessons, and physical theatre applications. Being outside of the conventional learning environment (the classroom), the students experienced learning in a different way – via performing arts – while still in compliance with the national syllabus.



Pic 3: The researchers with the Headmaster of SK Pekan Ranau, Mr Mostajah@Zunaidi bin Dullah at closing session.



Picture 1: Readers Theatre activities in interactive theatre session.



Picture 2: Body movement and physical theatre activities

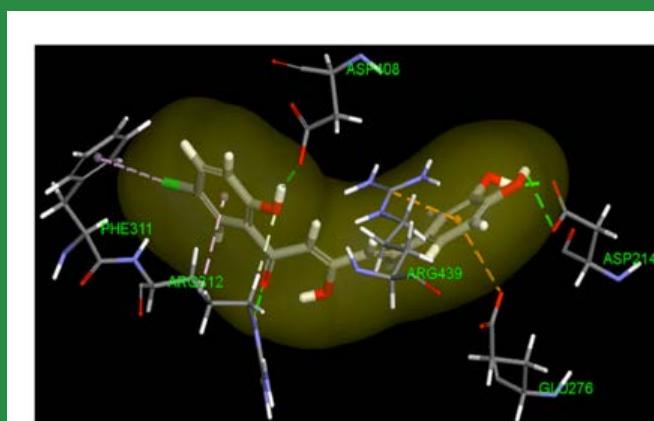
Seeing the children grow physically and mentally throughout this program, it reminds us of a Chinese proverb on education, "Tell me and I will forget. Show me and I will remember. Involve me and I will understand." As a research intervention, the performing arts activities can potentially bring about positive changes in performing arts education with young children in rural areas and further enhance a sense of community and togetherness with the environment.

LEVERAGING ON ANTIOXIDANT AND ANTI-INFLAMMATORY PROPERTIES OF CURCUMINOID DERIVATIVES

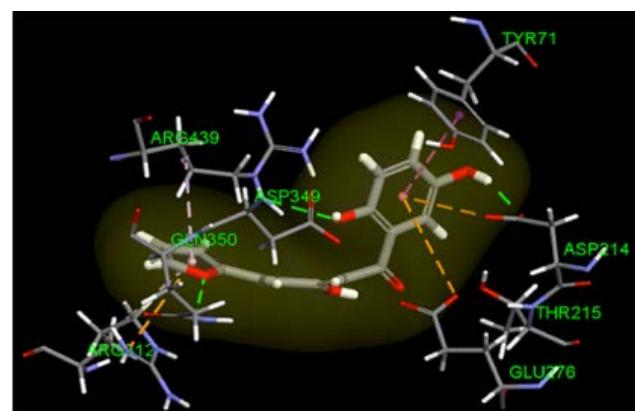
ASSOCIATE PROF. DR. FARIDAH ABAS (UPM), DR. LAM KOK WAI (UKM),
PROF. DR. KHOZIRAH SHAARI (UPM), DR. LEONG SZE WEI (UPM)

Diarylpentanoids is the most potent family of curcuminoid derivatives due to its excellent stability and multiple medicinal properties. Diarylpentanoids are well-known for their great antioxidant and anti-inflammatory properties based upon their ability in suppressing numerous free radicals and pro-inflammatory cytokines such as 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical, superoxide radical, hydroxyl radical, tumor necrosis factor alpha (TNF- α), and interleukins. On top of this, diarylpentanoids are also recognized as potent anti-cancer agents due to their outstanding inhibition on various cancer cell lines as well as in vivo tumor suppression effects on both zebra fish and BALB/c nude mouse models. Interestingly, recent studies reported that diarylpentanoids are non-toxic on in vivo mice models which provide them with extra tokens in the search of new drugs with minimal side effects.

A series of thirty-four diarylpentanoid derivatives were synthesized and evaluated for their α -glucosidase inhibitory activity. Eleven compounds (19, 20, 21, 24, 27, 28, 29, 31, 32, 33, and 34) were found to significantly inhibit α -glucosidase in which compounds 28, 31, and 32 demonstrated the highest activity with IC₅₀ values ranging from 14.1 to 15.1 μ M. Structure-activity comparison shows that multiple hydroxy groups are essential for α -glucosidase inhibitory activity. Meanwhile, 3,4-dihydroxyphenyl and furanyl moieties were found to be crucial in improving α -glucosidase inhibition. Molecular docking analyses further confirmed the critical role of both 3,4-dihydroxyphenyl and furanyl moieties as they bound to an α -glucosidase active site in different modes. The overall result suggests that diarylpentanoids with both five membered heterocyclic ring and polyhydroxyphenyl moiety could be a new lead design in the search of novel α -glucosidase inhibitors.



Binding interactions of compound 31 with the active site residues of α -glucosidase receptor



Binding interactions of compound 32 with the active site residues of α -glucosidase receptor

CO₂ CAPTURE AND UTILIZATION TOWARDS SUSTAINABLE DEVELOPMENT

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The ever-increasing climate change poses global risk to the society and environment where basic elements of life are threatened and natural balances are disturbed. In striving for sustainable development, Malaysia has committed along with 193 other countries to support and implement the 2030 Agenda and Sustainable Development Goals (SDGs) at the United Nations General Assembly. Accordingly, SDG 13 is to take urgent action to combat climate change and its impacts.

Greenhouse gases are the prime drivers of the so-called global warming and among them, carbon dioxide (CO₂) has contributed significantly to climate change. One of the key technologies to mitigate the challenge of climate change and also to alleviate the

world's energy crisis is Carbon Capture and Utilization (CCU). The CCU strategies seek ways to mitigate the accumulation of CO₂ in the atmosphere and scope to offer comprehensive solutions for conversion of CO₂ to marketable fuels and chemicals.

With the aim of developing a long-term strategy in line with USM's sustainability initiatives, the Low Carbon Economy (LCE) group; led by Prof. Abdul Rahman Mohamed, is working on CO₂ capture and conversion technologies to produce synthetically flexible and useful molecules from CO₂. The active LCE projects include development of carbonaceous and nanomaterials for CO₂ capture and use of them as catalyst for CO₂ conversion, CO₂ hydrogenation to methanol, CO₂

reforming of methane to syngas, photocatalytic reduction of CO₂ to CO₂ and other hydrocarbon fuels including methanol and CH4, CO₂ char gasification to produce CO₂, and synthesis of graphene from biogas which contains considerable amounts of CO₂.

USM has also established successful international collaborations with other universities in Japan and France. The LCE projects are undertaken by a number of postgraduate students and, so far, significant achievements have been attained which can contribute to the advancement of knowledge and solving the technical problems. A scale-up of these projects along the same lines would provide potential routes to move towards sustainable development.





PIÑA COLADAS: A PHARMACEUTICAL COCKTAIL OF PINEAPPLES AND COCONUTS

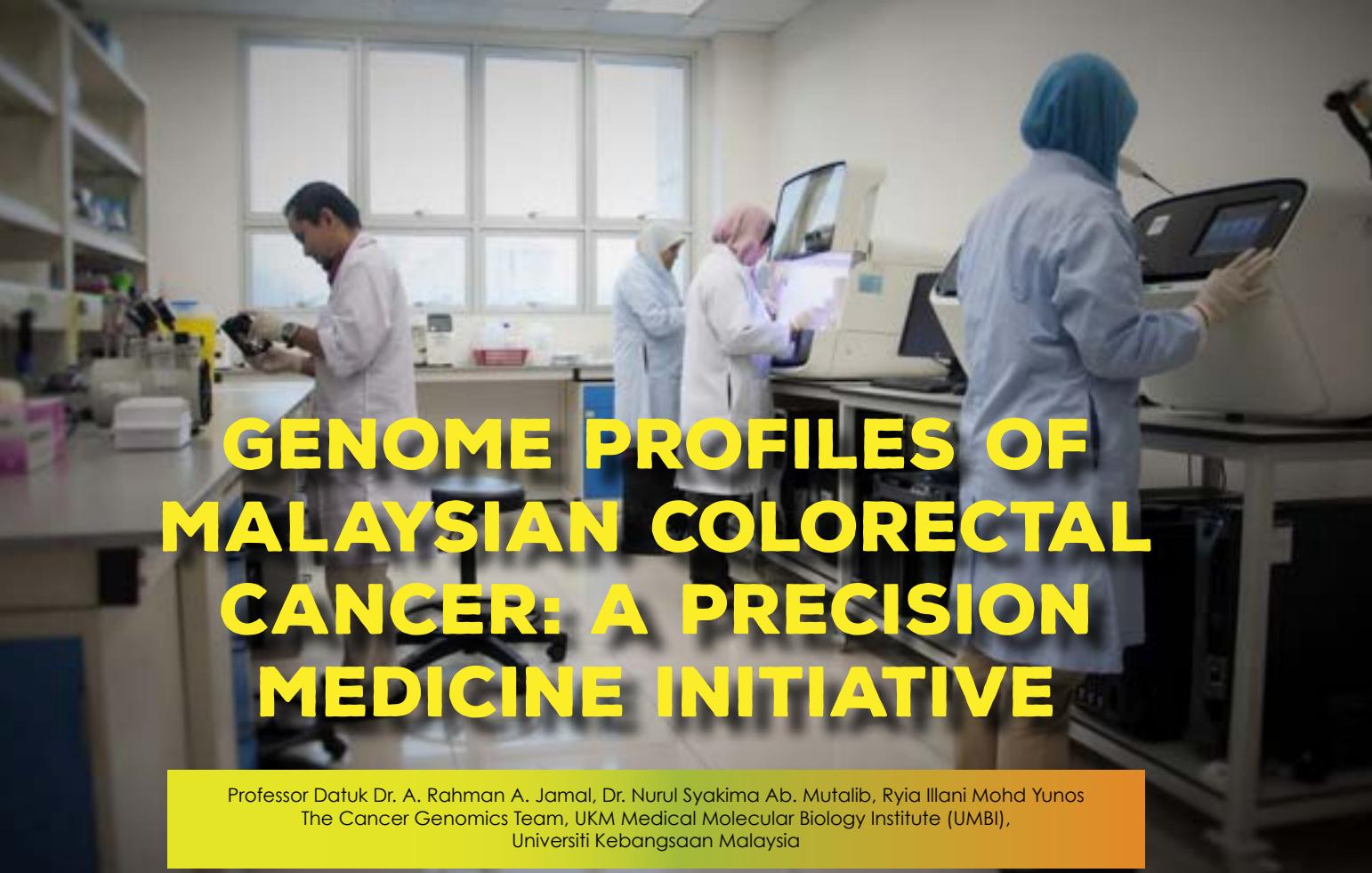
Pineapples and coconuts are excellent sources of antioxidants; they possess anti-carcinogenic, anti-mutagenic, antimicrobial, and antioxidant properties.

The pineapple *Ananas comosus* has mainly been used in the food industry and in the pharmaceutical sectors. In the food industry, only the fruit itself is used whereas the rest of the plant is discarded. It has been established

that biomass waste can be converted into useful byproducts such as charcoal and pyroligneous acid. Pyroligneous acid is a crude condensate produced from the distillation of smoke generated from the biomass carbonization process. Acetic acid, present in pyroligneous acid, can be used to discourage the growth of fungal strains and molds. Pyroligneous acid is found to exhibit great potential in acting as an anti-

inflammatory agent.

Cocos nucifera, the coconut, is a varied crop native to tropical regions. Ethnopharmacological studies have demonstrated the antimicrobial, antiviral, antineoplastic, anti-inflammatory, and analgesic properties of *Cocos nucifera*. The coconut is also a possible natural inflammatory inhibitor that functions by blocking the body's receptors.



GENOME PROFILES OF MALAYSIAN COLORECTAL CANCER: A PRECISION MEDICINE INITIATIVE

Professor Datuk Dr. A. Rahman A. Jamal, Dr. Nurul Syakima Ab. Mutalib, Ryia Illani Mohd Yunos
The Cancer Genomics Team, UKM Medical Molecular Biology Institute (UMBI),
Universiti Kebangsaan Malaysia

Colorectal cancer (CRC) is the 2nd commonest cancer among Malaysian men and 3rd commonest in women. The majority are diagnosed at the late stage, and the overall five-year survival rate is only 50%. There is a high level of genetic heterogeneity in CRC which is due in part to changes at the molecular level which include genetic mutations and structural variations.

The advances in genomic technologies have allowed in depth analysis of cancer including doing whole genome sequencing of cancers (WGS). The cost of WGS is now about RM6000 per genome. Many of the published studies on genome profiling of CRC involved

patients in Western countries.

The international fraternity is encouraging more research using WGS on the Asian population. The Cancer Genomics team at the UKM Medical Molecular Biology Institute (UMBI), has conducted WGS in 50 Malaysian CRC cases. The research is funded via the Long Term Research Grant Scheme (LRGS) from the Ministry of Education. The WGS has generated a large set of genome data (Big Data). The first phase analysis shows mutation profiles of our local patients including those commonly seen in Western populations i.e. KRAS, TP53 and APC. In addition we have also identified novel mutations which seemed more common, and even

some that were unique in our local patients. We have also identified mutations which can be targeted using drugs/agents which could improve the survival rate of patients.

We are proud to announce the development of UMBI Genome Database to store the large set of genome data from this project and other genome-related studies at UMBI. We believe our genome database is the largest of its kind in Malaysia. This is the first study showing the comprehensive genomic landscape of local CRC patients and will provide a road map to facilitate genome guided personalized therapy in Malaysian patients.

SOPHISTICATED SOLUTIONS FOR HIGH-RISK LEUKEMIA

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Survival rates for acute lymphoblastic leukaemia (ALL), the commonest childhood cancer, have improved dramatically over the past four decades at UM from 40% in the 1970s to >85% currently. This stellar achievement is largely due to collaborative research between UM and the National University of Singapore (using the joint acronym 'MASPORE') which has been in place since 2003. However, despite risk-adapted therapy, 15-20% of childhood ALL patients are still not cured. Thus, high-risk leukaemia is currently an area of active research led by the MASPORE group in which innovative treatment methods are being designed.

Ryan, aged 8 years, is one of the children who has benefited from the sophisticated treatment solutions offered at UM. Although his parents were learning to accept the devastating news of his leukaemia, they grew despondent when he failed to respond to the first phase of therapy. This was a predictor of high-risk disease and low survival rates. Conventional laboratory investigations failed to yield clues as to the cause for his poor response to chemotherapy. However, the UM Paediatric Oncology Research Laboratory, through collaboration with the Children's Hospital of Philadelphia, then studied Ryan's leukaemia cells via RNA sequencing. A rare fusion transcript, FOXP1-ABL1, was detected. This was a key finding as this transcript was targetable using a tyrosine kinase inhibitor. Professor Hany Ariffin, the lead investigator and director of the research laboratory, then amended Ryan's chemotherapy regime by combining targeted therapy with the MASPORE-ALL high-risk protocol and finally, his bone marrow was free of leukemia.

A similar challenge arose for Yu, a 2 year old girl who was diagnosed with ALL in early 2018. She was initially managed in another hospital but had an unexplained poor response to chemotherapy. Standard lab investigations could not elucidate the reason for her seemingly recalcitrant disease.

Yu's leukaemia cells were then interrogated at the Pediatric Oncology Research Laboratory at UM where a fusion transcript involving the mixed-lineage leukaemia gene, KMT2A, was detected. This information led the team to increase treatment intensity and introduce additional chemotherapeutic agents in her protocol. With this, little Yu was able to achieve both morphological and molecular remission.

However, the story does not end there.

Patients with high-risk leukaemia require bone marrow transplantation in order to achieve long-term cure. As bad luck would have it, neither Ryan nor Yu had suitably matched donors. Their happiness appeared destined to be short-lived.

Fortunately, blood stem cell transplants for children using mismatched or haploidentical (half-matched) donors had been pioneered at UM since early 2016. Ryan received mismatched stem cells from his elder sister whilst Yu's father became her donor.

It has been many months since Ryan and Yu underwent their transplants. They have remained well, with no detectable disease; they are hopeful at a chance of a complete cure. Ryan, is looking forward to returning to school soon while Yu eagerly awaits her first day in kindergarten. Their parents now also have something to look forward to – watching their children grow up to become healthy adults.

Professor Hany Ariffin shares the happy outcomes of the patients with her staff of dedicated clinicians and scientists. She pays tribute to her team members who have remained steadfast despite the many challenges faced, and the charitable donors who have supported their work.

The amiable professor adds,
"Finding cures for children with cancer such as Ryan and Yu is our mission – and their smiles are our reward".

INVESTIGATION OF MAGHEMITE-REDUCED GRAPHENE OXIDE (FE₂O₃-RGO) NANOCOMPOSITE FOR HEAVY METAL DETECTION USING OPTICAL WAVEGUIDE SURFACE PLASMON RESONANCE

As industries rapidly expand to meet the demands of massive dynamic development around the globe, plumbum (Pb²⁺) contamination is a persistent and yet unsettled environmental issue. The exposure to Pb²⁺ is known to cause severe systemic diseases even at very low concentrations. Over the past few years, researchers have shown enormous interest in surface plasmon resonance (SPR) based sensors due to their sensitivity and fast response in chemical, biological, and environmental sensing applications. The attachment of a nanocomposite-sensing layer to plasmonic material has created vast integration for sensitivity and selectivity enhancement in detecting the presence of heavy metals.

The focus of this research is Pb²⁺ ion detection using an SPR sensing layer i.e. a new nanocomposite identified as 'reduced graphene-maghemite (rGO/γ-Fe₂O₃)'. The main aspects of the

study are: (i) the sensing potentiality of rGO/γ-Fe₂O₃ in a prism-based SPR sensor technique; (ii) the protection of the rGO/γ-Fe₂O₃ from degradation in water environments; and (iii) the detection of plumbum in water using rGO/γ-Fe₂O₃ at sub ppb detection limits.

For heavy metal ion detection, its main challenge is the erosion of graphene-based nanomaterial when the layer interacts with aqueous analytes. Therefore, a special material matrix is required to enhance the adhesiveness of rGO/γ-Fe₂O₃ to the gold (Au) layer on SPR. The combination of the Au-rGO/γ-Fe₂O₃ sensing layer and 1-Ethyl-3-(3-dimethylaminopropyl) carbodiimide/ N-Hydroxysuccinimide/ (EDC/NHS) as a protection layer is used in the sensor structure. The optimized thicknesses of Au, rGO/γ-Fe₂O₃, and EDC/NHS are 41nm, 8.75nm, and 4nm respectively, and the limit of detection for Pb²⁺ ions is 0.001 ppm in static water conditions. This

limit of detection is further enhanced to 0.3 ppb by adopting the water circulation method. Selectivity of Pb²⁺ ions is greatly enhanced, by replacing EDC/NHS with polyvinylchloride (PVC).

This work highlights the advantages of the rGO/γ-Fe₂O₃ nanocomposite when used as a sensing layer on an SPR based sensor for the detection of Pb²⁺ ions in water. Its sensing performance has shown great potential in matching the need for a robust, cheap, sensitive, and selective sensing method to detect heavy metals in order to curb related environmental problems. The quantitative research findings are: (i) a 1.1-degree angle shift in 10% concentration vapor acetone; (ii) EDC/NHS enhanced the sensing layer to work under water circulation effect for 50 experiments; and (iii) the detection of Pb²⁺ ions in water at 0.3 ppb concentration.

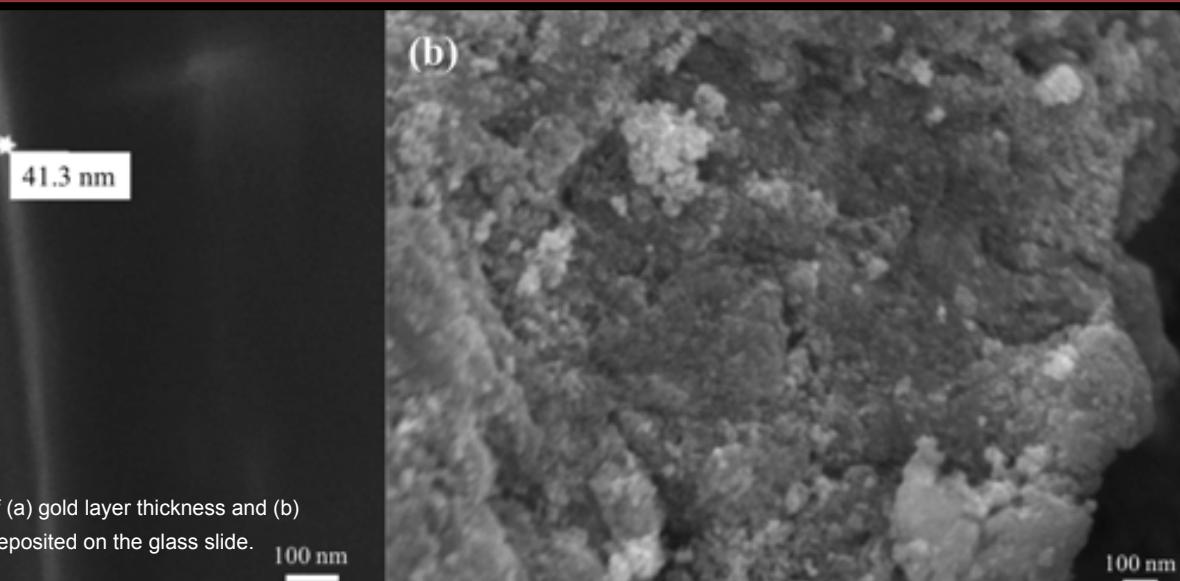


Fig. 2. FESEM image of (a) gold layer thickness and (b) rGO/γ-Fe₂O₃ powder deposited on the glass slide.



KELI: A HUMBLE & SUSTAINABLE FISH FOR ZERO HUNGER

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Keli Lestari is an effort by researchers at Universiti Sains Malaysia designed to promote good quality keli for the consumer, and to empower the keli culture operators with sustainable and good aquaculture practices. Keli or Clarias catfish is a freshwater fish mainly farmed in South East Asia and Africa by small scale farmers, and it thrives on a fish-meal free diet.

The keli is an omnivore, and an air breather; it grows fast and responds well to induced spawning thereby making it suitable for farming in culture systems. In fact, there is a niche market for cultured keli as it is a favorite freshwater fish in Malaysia. Due to its omnivorous behaviour, farm operators feed keli with animal and poultry carcasses and waste; this translates as near to no cost of feeding. Although this practice helps in reducing pressure on fisheries' resources and maintains the market value at an affordable pricing, the operation is unsustainable.

This bad practice causes water pollution and produces unhygienic, unhealthy, and low-quality keli. In previous years, consumers were unaware of what constituted good and healthy keli. Nowadays, this paradigm is starting to change. The main challenge in Keli Lestari culture is to maintain its market value at an affordable price while sustaining the production of healthy, good quality fish. Changing the mindset of keli farm operators who, for years have used poultry and animal carcasses as fish food, seems an almost impossible task. Instead, what is more plausible is to strategically empower the younger members of the community who actively choose sustainable food systems to champion the transformation of the paradigm from "keli, the poor man's fish" to "keli, the sustainable fish".

TEXTILE WAVEGUIDE JACKET WITH ANTENNAS FOR BODY CENTRIC COMMUNICATION

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¹Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia

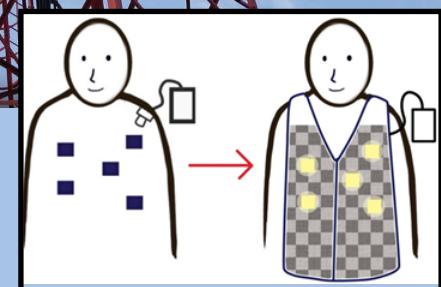
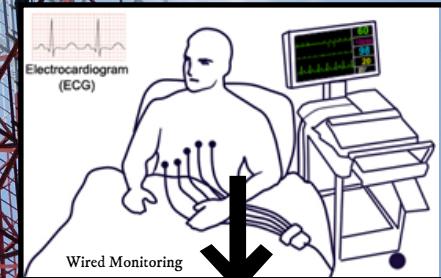
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There has been remarkable interest in body centric communication in recent years, where wearable technology that is non-rigid and comfortable is desirable. A smart clothing concept that offers wireless functionality is much more desired than the conventional wired system.

However, due to the distinct properties of the human body, wearable antennas experience performance degradation. Furthermore, the radiation that penetrates the human body is a worrying health issue. The human body also causes unwanted high transmission loss between antennas that can cause higher propagation loss and unreliable

transmitted information e.g. wrong data in ECG and poor music quality in personal entertainment systems.

In this study, a new approach using a waveguide sheet to complement the wearable antennas is proposed. Waveguide is a structure that provides a path for the propagation of electromagnetic (EM) waves. EM waves will be strongly concentrated into the Artificial Magnetic Conductor (AMC) surface that allows transmission through the waveguide sheet, hence contributing to transmission enhancement between the antennas. The waveguide jacket also acts as a radiation shield.



Wireless Monitoring with Transmission Enhancement



Multiple Wireless Device Integration Development



Anti-Radiation Clothes

This product is entirely made from flexible yet robust textile material. The proposed textile waveguide jacket can be easily worn and is comfortable for the user. It can be applied in body centric applications e.g. ECG monitoring and personal entertainment. For the ECG system, it can be applied to improve the transmission of the patient's vital signals to the ECG machine wirelessly. The jacket will act as a data collecting medium and wireless sensors will be coupled to the jacket.

For the personal entertainment system, it can be used to guide the signals from devices such as an MP3 player to the headphones wirelessly. Interaction and data transfer between control unit and data storage device are also possible.

Some other potential applications are Anti Radiation Clothing for people who are frequently exposed to EM radiation and Smart Outfit with Transmission Enhancement for Military Applications.

THE AGING FACES OF OIL PALM SMALLHOLDERS

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Many oil palm smallholders in Malaysia are senior citizens. What kinds of challenges do they face? As the second largest contributor in oil palm production, smallholders accounted for 39 percent of oil palm production. Thus, increasing household incomes especially in rural areas is crucial to the development of smallholders. Beneficiaries of the Oil Palm Replanting Scheme (TSSPK) who were respondents to our questionnaires and surveys revealed through their answers six issues and challenges faced by oil palm smallholders.

First, nearly two-thirds of the oil palm smallholders are elderly. This has a

negative impact on the productivity of farms affected by the scarcity of workers.

Second, smallholders on average have the highest education level of only Sijil Pelajaran Malaysia (SPM). This illustrates the low level of human capital among smallholders.

Third, due to old age, generally most of the oil palm smallholders are part-time farmers. Management of the lands are handed to the middle men beginning from planting, harvesting, and selling to the factory. The smallholders only receive a token of the profits. The price of fresh fruit bunches (FFB) varies due to the price

determined by the middle men. Fourth, smallholders' average incomes are low. Their incomes are highly dependent on external factors such as weather and price controls by the middle men. Moreover, most of them have a land size of less than five acres. Fifth, aged smallholders have difficulty in obtaining financing while aids given by the government are insufficient.

Sixth, the rising costs of fertilizers, pesticides, buds, and cleaning the land place further strain on their income. These six challenges faced by the smallholders may be the six straws that break the smallholders' spirits to press on in this industry.

THE FEMININE TOUCH: WOMEN IN THE ORANG ASLI GRASSROOTS MOVEMENT

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A research group from the University of Malaya devised a study to create awareness about the struggles faced by the orang asli community in Kampung Chang Lama, Bidor, Perak. The challenges faced by the community that were specifically targeted in the study are recognition of their rights and the advocacy to protect their livelihoods.

An interview with Tijah Yak Chopil revealed how her experience in raising literacy and education amongst the children began with the remodeling of her house to accommodate a community school. This initiative encouraged children, teenagers, and parents to take a deeper interest in education. The researchers then used this platform to generate more awareness about orang asli issues and rights.

One of the highlights of the study was the women's use of children's songs written in the local Semai language to create awareness of their plight, impacted teenagers, and aging members of the community. Through such opportunities, these women were able to provide the researchers with more information about family issues such as household economies.



Kaum Ibu is a group created within the community to collect food that is then shared with families in need. This group of women, with full support from their husbands and children, were also provided with opportunities to attend women's workshops. In 1995, the SPNS (New Life One Heart Group) was established to strengthen community linkages to communities in Negeri Sembilan, Pahang,

and Selangor. The creation of Jaringan Kampung Orang Asli Semenanjung Malaysia (JKOASM), a grassroots movement that advocates orang asli rights, has brought about a change in women's consciousness that has benefitted and empowered the community.

The findings of this research reveal that women like Tijah play significant roles in the community and are

catalysts in the JKOASM grassroots movement. This research has also paved the way for the research team to be part of the orang asli community which, previously, had largely been marginalized and left out of discussions on public policy. The study has provided the orang asli community with varied opportunities to have their voices heard.

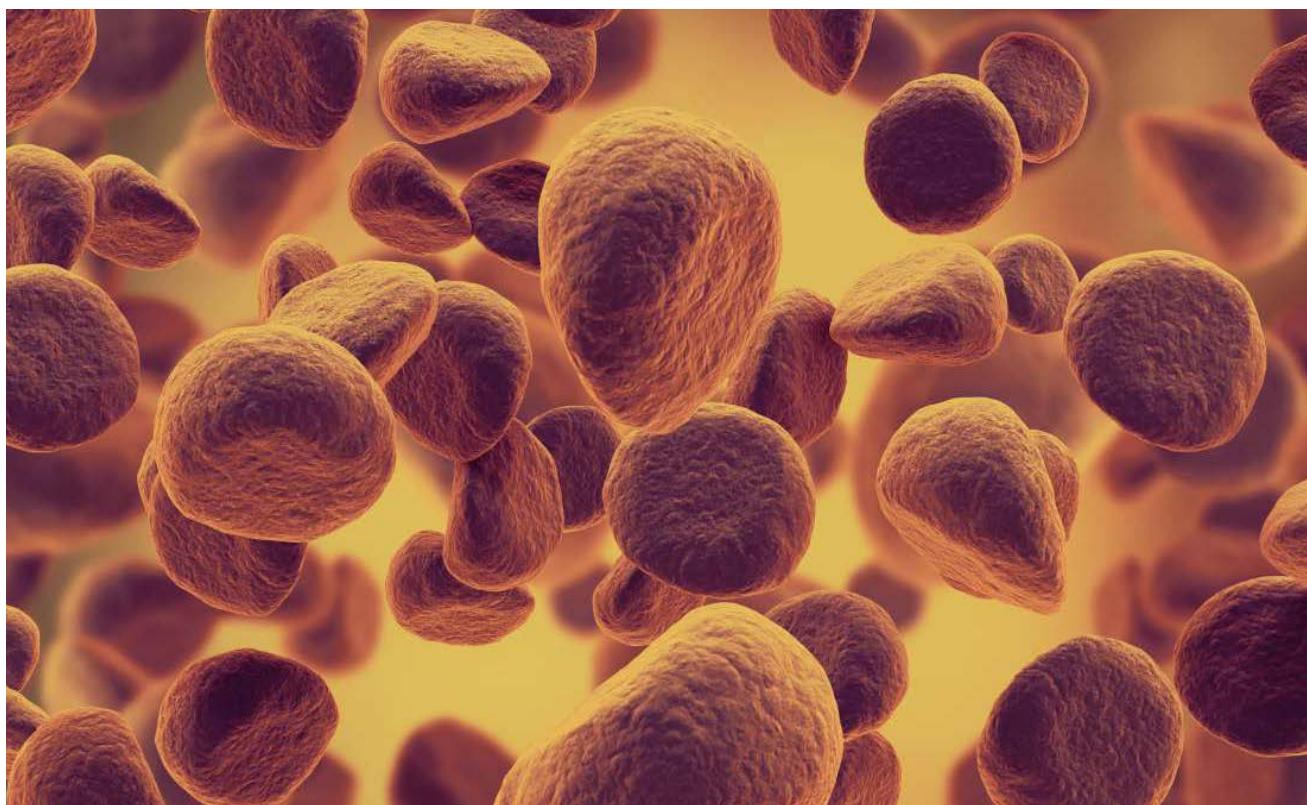
A GENETIC APPROACH TO UNDERSTANDING LEUKEMIA

Maha Abdullah | Universiti Putra Malaysia

Leukemia is a disease that causes the bone marrow to produce abnormal quantities of immature immune cells. This high volume of immature immune cells in the bone marrow then spills over into the blood stream via which they infiltrate the body's other organs. Childhood leukemia is successfully treated but survival rates are less optimistic among the older age groups. Leukemia is the seventh most common form of cancer in Malaysia and research has indicated that for Malay males, it is statistically the third most predominant cancer type. The causes of leukemia in most cases remain largely unknown. However, it is generally agreed that genetics might hold a key to understanding the disease.

At present, many aberrant genes have been identified and cancer formation could possibly be due to, among other factors, genetic polymorphism. The human leukocyte antigens (HLA) have been identified as the most polymorphic genes and certain alleles are conserved within ethnic groups. These proteins have a fundamental role in the function of the immune system which is also important in protecting the body against the growth of cancer cells. This research will combine HLA genetics and immune cells to determine if variations do influence the survival of leukemic cells. Advanced technologies in stem cell induction and genomic editing will be applied. For this purpose, we have

teamed up with experienced expert researchers from the Faculty of Medicine, Universiti Kebangsaan Malaysia, Prof. Datin Dr. Hamidah Hussin, a long-time collaborator who is a senior consultant hematologist from the Hematology Unit, and Dr Fazlina Nordin from the Cell Therapy Centre, who earned her PhD in stem cell research from King's College, London. Together with our own researchers in UPM as well as at Hospital Serdang, we hope to answer some questions regarding the genetic triggers of leukemia. This research is supported by the Ministry of Higher Education and was approved in August 2017 with a grant allocation of RM168 000.



Growing Figs in Malaysia

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In Malaysia, the fig (*Ficus carica*) is a new Superfruit currently being introduced locally due to its high nutritional qualities and its religious significance. The fig fruit is well known for its elevated levels of calcium, phenolic compounds, antioxidants, minerals, vitamins, and dietary fiber with its leaves possessing effective anti-diabetic properties. This fruit is grown primarily in the Mediterranean and is not found in tropical countries due to various environmental factors.

Fig plants are commonly propagated through conventional methods that are found to be less efficient due to low success rates. Alternatively, plant tissue culture technology offers a reliable technique in mass propagating plants at a consistent rate to yield clones of parents from novel varieties. This aspect allows the manipulation of media formulation and plant hormones under controlled sterile conditions thus enabling organized mass production of selected high quality healthy plants that can be further grown on farms.

Universiti Sains Malaysia is the first in the country to have successfully established tissue culture methods of figs for commercial scale plant stock production to enable the local commercialization of figs. The project also aims to promote the establishment of fig farms and to encourage the development of local Sunnah-based industries which in the long run will create new job opportunities, increase income generation, and encourage local entrepreneurs in the industry of fresh and processed produce, cosmetics, wellness, and pharmaceutical products.

At present, there are more than six types of fig cultivars (Black Jack, Texas Everbearing, Violette de Sollies, Japanese BTM6, Lisa, Brunswick etc.) of various colors and fruit quality that have been released by USM for local purchases at RM20 to RM35 per plant. This project will be further developed for the production of other Superfruit plant stocks for commercial purposes such as olive, lemon and caviar lime.

CULTIVATING SEAGRASS MEADOWS FOR SUSTAINABLE COASTAL ECOSYSTEM

Benthos features are very significant to the marine ecosystem. One of them is seagrass, a submerged marine flowering plant that lives in seawater. Seagrass is important for marine flora and fauna as they provide both food and shelter to other marine species (e.g. fish, sea turtles, dugong, etc.). The preservation and conservation of seagrass habitats are important to sustain coastal ecosystem health; they have become a priority to the agencies, coastal management, and bodies who manage and monitor seagrass habitats.

At present, the implementation of seagrass habitats mapping techniques for managing and monitoring has generally failed to take into consideration the production of high spatial resolution maps of these habitats. Underwater acoustic sonar devices such as high-resolution Multibeam Echosounders (MBES) in marine applications have been identified as important tools for remote seafloor classification and characterization. MBES produce detailed bathymetry data for the seafloor surface, as well as the seafloor intensity (e.g. hardness and softness). The application of these datasets as predictor variables for seagrass

species distribution models will be examined to provide invaluable data in mapping marine environments.

This study attempts to address the morphological seafloor characteristics to produce seagrass species distribution models at high spatial resolutions. These models may assist the delivery of ecologically relevant information to any agencies, coastal management, and relevant bodies to manage and monitor seagrass habitats. Thus, effective conservation and protection of the biological diversity in the marine environment could be achieved.

THE MAKING OF SOLAR PANELS AS COTTAGE INDUSTRY

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The making of solar panels i.e. photovoltaic panels (PV) is usually associated with high technology manufacturing processes, automation, and high capital cost. The global demand for solar panels has an annual growth rate of 10% as new markets open up and installation costs drop.

Almost 90% of the solar panels are classed as large panels with a capacity of 100W and are mainly used in rural electrification and grid connected applications. Large panels can be obtained easily from big name manufacturers all around the world. The remaining 10% of the market for small solar

panels are mainly niche markets for street lighting, educational kits, garden lighting, and solar panels for recreational activities. The full automated equipment normally found in large factories cannot be tailored towards making these small panels. A cottage industry is able to fulfill the demand for these small solar panels (20 to 60 Watts).

The UKM Solar Energy Research Institute UKM, in collaboration with Solartif Sdn. Bhd., has developed a solar panel making industry, also known as a PV cottage-industry model, for high quality solar panel production. A cottage-industry based business model aimed at manufacturing small solar panels as well as large

solar panels with an estimated capacity of 1 MW/year has been set up in Terengganu, Malaysia.

The project objective was to reduce the PV cost manufacturing by tailoring the technology to the socio-economic culture of the society. Almost all the equipment and manufacturing processes were developed with process and performance yields comparable to any automated operation. The processing methods are simple and use local products and equipment. Many customized PV panels can be produced at very low cost and create job opportunities, and enhance the socio economic outlook for the local population.

KEFIR: FERMENTED MILK AND DIABESITY



Kefir is a traditional beverage that is usually made from the fermentation of milk by kefir grains. Kefir grains, comprising a wide diversity of bacteria and fungi, are believed to have originated in the Caucasus mountains in Central Asia about a thousand years ago. Some of the health-promoting properties of kefir include improvements in the body's immune system and lactose digestion, and antimicrobial, antiviral, and high antioxidant activities.

The most common microorganism that exists in kefir grains are yeasts known as *Saccharomyces* sp., *Kluyveromyces* sp., and *Cryptococcus* sp., and lactic acid bacteria (LAB) such as *Lactobacillus* sp., *Lactococcus* sp., and *Leuconostoc* sp. Although kefir milk has recently become a popular health drink in Malaysia, at present, there are virtually no reports or validation regarding the source, microbiota composition, method of fermentation, and health benefits of kefir grains originating from Malaysia.

The results of a 2015 survey in Malaysia indicated that 17.7% of Malaysians were obese (Institute for Public Health, 2015). Obesity is caused by an uncontrolled intake of dietary fat and sugar in daily life. The manipulation of gut microbiota via the consumption of the correct probiotic has proven beneficial in treating high cholesterol levels. A previous study on an isolated LAB from Tibetan kefir showed a reduction in cholesterol-related blood serum in hypercholesterolaemic rats. To date, there is comparatively very little literature concerning the association of Malaysian kefir consumption with the effects on gut microbiota in diabetic-obese subjects.

The aim of this study is to characterize and standardize the production process of kefir, and to validate its health benefits with specific regard to diabetes-obesity disease *in vivo*. By looking at the gene expression profile, we hope to understand the different types of pathways that become regulated when treated with kefir.

Evaluation of anti-diabesity effects of non-dairy gallic acid-enriched kefir drink and in-depth analysis of metagenome and transcriptome profiles

Kefir grains sample from different sources of Selangor, Malaysia

SAMPLE A



SAMPLE B



SAMPLE C



SAMPLE D



SAMPLE E



SiL-RH MEMBRANE DISTILLATION: FROM SEAWATER TO DRINKING WATER

“Fresh water is the world’s first and foremost medicine.”

Mohd Hafiz Dzarfan Othman, Siti Khadijah Hubadillah, Ahmad Fauzi Ismail, Mukhlis A Rahman, Juhana Jaafar
School of Chemical and Energy Engineering,
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Unfortunately, fresh water is scarce and more than one billion people in the world, especially in developing countries, do not have access to it. According to the United Nations World Water Development Report, around 780 million people lack access to drinking water while the demand for processed water is expected to increase by 400% between 2000 and 2050 globally. Due to this reason, seawater desalination nowadays receives much attention since seawater constitutes >97% of the total water on the earth. Accordingly, many investigations on seawater desalination technologies have been reported in the literature.

An early investigation on seawater desalination was carried out through reverse osmosis (RO), where a spiral-wound thin film composite membrane was used to achieve more than 99% of salt rejection. It was reported that RO is the most

globally widespread technology for seawater desalination. However, desalination using RO is an energy intensive process. Furthermore, the RO process is not able to reject boron satisfactorily in its boric acid form in seawater. In addition, the water treated through RO may not contain precious minerals such as calcium and magnesium which are necessary for maintaining good health. The SiL-RH Membrane Distillation was developed to overcome these problems.

The SiL-RH Membrane Distillation is a newly developed and cost effective system for seawater desalination. The heart of this system is the precious green ceramic membrane that was developed from waste rice husk and prepared through phase inversion and sintering technique. Prior to the green ceramic membrane preparation, the waste rice husk was converted into silica based rice husk ash through a 1000°C burning

process. This system demonstrated 99.99% of salt rejection to produce drinking water from seawater.

This invention has won the Special Award from the Vietnam Fund for Supporting Technological Creations (VIFOTEC) and a Gold Medal at the Seoul International Invention Fair (SIIF) 2017, Korea. In addition, this invention has received a number of collaborations locally and internationally. At the national level, memorandums of understanding (MoUs) have been signed between the Advanced Membrane Technology Research Centre (AMTEC) and Aliran Ihsan Resource Berhad, and also with Sime Darby, Malaysia. In addition, this invention has also received research funding from international bodies such as the Kurita Water and Environmental Foundation, Japan and the Nippon Sheet Glass Foundation, Japan.

WORKMATES AND MEAL BUDDIES

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Universiti Kebangsaan Malaysia | mnmansor@ukm.edu.my

This research was primarily concerned with how ethnic relationship patterns shape human social interactions in the work arena. Beginning with the assumption that the Malaysian individual's sense of self-worth and understanding of their core identity stem from the degree to which they have embraced their ethnic and religious backgrounds, the research findings indicate that one's social behavior is determined by a sense of ethnic identity, religious beliefs, and locality.

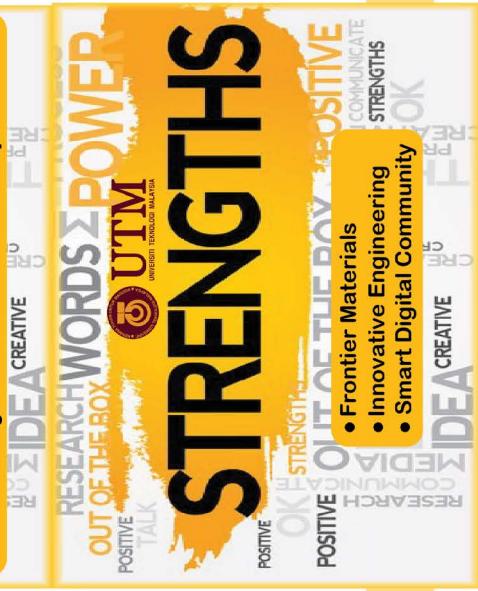
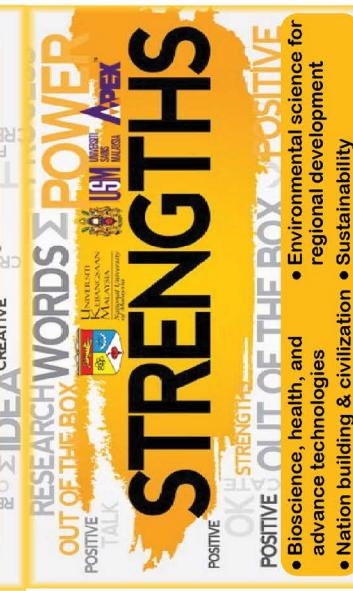
Within the workplace and in dealing with others from different ethnicities, it was discovered that office workers tended to congregate with

others of similar ethnicities during meal breaks. Such innate religious and ethnic polarities were however quickly and seamlessly discarded when work related matters came to the fore.

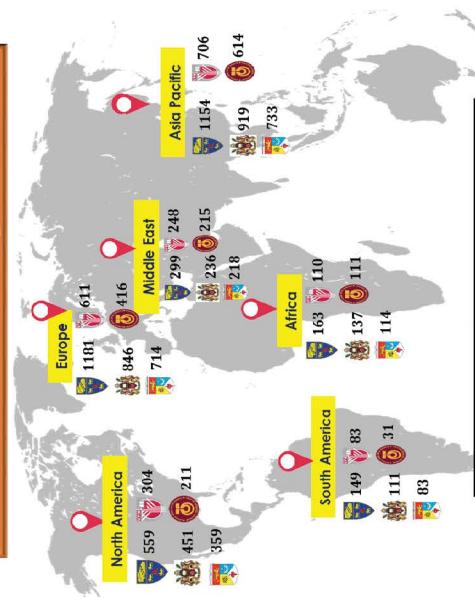
The most compelling factor for individuals to set aside ethnic differences to work cohesively is the collective promise of material profit. The individual's ethnic considerations fall secondary to material gain in their effort to provide a socially viable lifestyle for their families. It can therefore be concluded that the nature of one's social relationships can be based on both ethnicity and social mandates.



AREA OF RESEARCH STRENGTHS



Global Networking of MRUS



Regions	% Collaboration
Asia Pacific	35%
Middle-East	10%
Africa	4%
Europe	32%
North America	16%
South Africa	3%

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MRUN

Malaysian Research University Network



WHO WE ARE?

MRUN is a consortium of research intensive universities that serves as a network of “elite” universities in Malaysia to enhance research in Malaysia which delivers talents and aids in social innovation and economic growth for the country. MRUN members are committed to the pursuit of the highest quality research, research-training and teaching to help realise the Government’s T50 agenda and prepare the society and nation for challenges of the future world.

VISION

To be the nation’s engine of growth through advancement of knowledge & innovation for wealth creation & societal wellbeing.

MISSION

Spearsheads impactful research of global prominence that enhances societal inclusivity and

UM, UKM, USM & UPM received RU status

All RU Moving together as a MRUN

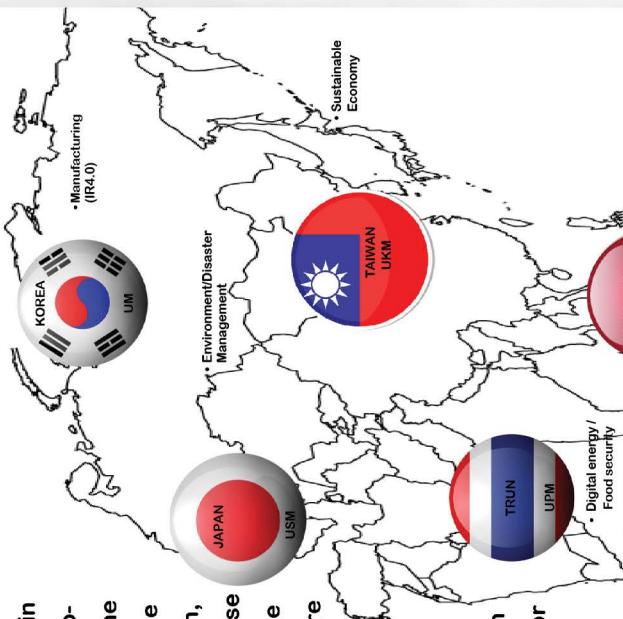
2006

2010

INTERNATIONAL

RESEARCH COLLABORATION

International Collaboration with Regional Universities:



Work with Rakan RU in the translational research programs

With MTUNs & MCUNs : in areas of applied research, in particular translating research output from RU into products/prototypes.
Like MTUNs should take the discoveries in MRUN and turn it into useful technologies for the country.

TRANSLATING RESEARCH OUTPUT



RAKAN RU CONSORTIUM	UNIVERSITY
Malaysia Technical University Network (MTUN)	UTHM, UTEM, UNIMAP, UMP
Malaysia Comprehensive University Network (MCUN)	UITM, UMS, UNIMAS

DOMESTIC

MRUN

Malaysia Research University Network

BULLETIN



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