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MESSAGE BY THE DIRECTOR OF CERVIE

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UCSI University

The COVID-19 pandemic caught all the nations around the world unprepared and the year 2020 was indeed a challenging year for all individuals and economic sectors in Malaysia. As one of the emerging young private universities excelling in research and scholarly activities in Malaysia, UCSI University researchers continue to make impressive progress with increased numbers of high impact journals and external grants secured despite the strike of the pandemic. The year 2021 will be a year full of uncertainty with the presence of the COVID-19 pandemic, however, UCSI University's research community will continue to make an impact and enhance the visibility of research and scholarly activities of the university in the international arena. Along with the continuous enhancement in research performance and strengthening of industry networks and linkages, we believe UCSI University will continue to rise in the QS World University Rankings in years to come.

With that, I welcome you to the first volume of **Research@UCSI** of year 2021 which provides insights and updates of the University's research and scholarly activities. This monthly newsletter is one of CERVIE's initiatives to foster an effective research culture in UCSI University, serving as a platform of communication with the UCSI community and encouraging multidisciplinary research collaboration both within UCSI University and with external parties.

Together, we strive for research excellence at UCSI University.

Content

FINDING JOY IN RESEARCH

Associate Professor Dr Wong Chen Wai

Academics are often told that research is important for their career advancement and they should aim for high citations, H-index and a lot of grants. Indeed, Associate Professor Dr Wong Chen Wai started research with this in mind. However, as she expanded her network and circle of friends, she realised research was much more than simple numbers.

Early in her career, the main motivating factor for Dr Wong was a sense of achievement and the promise of a promotion and financial gain. While these are all valid reasons for one to pursue research, they are not enough to sustain long-term interest in research. It did not take too many years before she felt that her research and career progression reach a plateau.

Associate Professor Dr Wong Chen Wai (left) facilitated the signing of a MoU between UCSI University with Dr Kustiariyah from Institut Pertanian Bogor.

Without continuous progression, research seemed to have lost its appeal. Dr Wong started reaching out to others, starting with her colleague, Associate Professor Dr Eric Chan Wei Chiang. As the conversation progressed, more interesting ideas surfaced and she started expanding her research area from enzymes, to phytochemistry and green materials. Dr Eric was the first in their small group to get a Fundamental Research Grant Scheme (FRGS) and they slowly expanded their group by taking in postgraduate students.

Sharing our research at Universitat Salzburg before presenting at Berlin. Dr Wong (right) and Dr Eric (left) and their students Pei Xin and Caroline.

In 2016, their research was one of the Top 5 Finalists for the Elsevier Green Chemistry Challenge and they presented their research in Berlin. This was a fruitful trip as it opened up many new opportunities for the group. One of their former students, Wai Tuck who was doing his PhD in Salzburg got to know about the award and they were invited to present their research at the University of Salzburg before going to Berlin. At Berlin, they met with Professor Dr Suzana from Universiti Teknologi Petronas who was another finalist who later won the 2nd prize at the competition.

Associate Professor Dr Wong Chen Wai with Professor Dr Suzana 2016 in Berlin (right) and at a research meeting at UCSI University in 2019 (left). Such chance meet ups can be the starting point for future collaborations.

Soon after returning from Berlin, Dr Wong was awarded her own FRGS grant in 2018, and her research started to expand. In 2019, Dr Wong met Professor Dr Suzana again at a research meeting in UCSI University and their past relationship allowed them to work on a collaboration to apply for a larger multi-project research grant together with Associate Professor Dr Eric Chan Wei Chiang.

Students in their research group also benefitted from these friendships and had many opportunities to travel. In 2015, Professor Dr Lee from Konkuk University brought Dr Wong and her students on a short trip around Seoul, Korea. In Korea, Dr Wong also met with Dr Iriani from the Institut Pertanian Bogor (IPB), which allowed the signing of an MoU that facilitated student exchange between the two universities. In 2019, Dr Wong got to know Dr Ivanhoe from the University of Auckland who offered to support the registration fee for her PhD students. Two of these PhD students ended up winning prizes at the Green Chemistry New Zealand 2019 conference.

Chance meetings also played a role in driving research. In 2017, Cai San a former BSc Food Science student introduced Dr Wong to Mr Wilfred the owner of Benn Ethicoa who proposed a research project on cocoa tea. In 2020, Cai San graduated with an MSc in Applied Science, and her cacao tea is now available in the market.

Research can indeed be very dry but it can also be very meaningful as we start forming meaningful friendships. In their research group, Dr Wong's main expertise is enzymes and Dr Eric's expertise is biomolecules, two mutually complementary areas of research. To find joy in research it is important that we form such mutually supportive relationships with our colleagues and overseas collaborators. Dr Wong is very grateful to UCSI University for providing a supportive research environment.

MOBILE TECHNOLOGY STUDIES

Associate Professor Dr Garry Tan Wei Han

Associate Professor Dr Garry Tan Wei Han

Associate Professor Dr Garry Tan Wei Han is an avid researcher with a passion to study the behaviours of consumers in accepting mobile technology. Specifically, he is interested in exploring consumers' psychological behaviours and how they react to the adoption process from the marketing viewpoint of different industries such as in tourism, hospitality, retailing, entertainment, education, etc. He said that while there are many benefits rendered from using mobile technology, the adoption rate remains low. To better explain the adoption process, Dr Tan and his co-author, Professor Dr Ooi Keng Boon created a new model namely 'Mobile Technology Acceptance Model (MTAM)' in 2016 which was subsequently published in Expert Systems with Applications (Elsevier). "While most past studies on mobile technologies were designed using electronic commerce literature which does not represent the actual mobile environment, MTAM overcomes the limitations by being among the few models in the world that is crafted specifically for researching mobile technologies", he explained.

He also illustrated that the model is applicable in various mobile adoption studies such as learning, tourism, healthcare, marketing, hospitality, etc. The model has since been recognised as one of the 'Highly Cited' papers according to the Essential Science Indicators (ESI), Web of Science in May/June 2020, which means it is within the top 1 percent of the academic field of Engineering, general based on a highly cited threshold for the field and publication year. Dr Tan has since established himself as one of the experts and a leading researcher in the area of mobile technology. His research work has also been identified in 2015 as the 'Most Critical 50 Highly Cited Paper' in Technology Acceptance Research based on an article published by Springer Link.

The ranking was based on the citation network constructed from 1555 journal articles published from 1989-2014 using Clarivate Analytics' (WOS) database. Since 2016 he has been rated as of the world '10 Most Productive and Influential Authors in Mobile Commerce and Applications' in Clarivate Analytics' (WOS) database between 2000-2015 in an article published by Telematics and Informatics. He has also been acknowledged as one of the 'Top 3 Authors in the World' in Mobile Commerce in 2017, 'World's Top 10 Core Authors' in Social Commerce in 2018 and 'Top 5 Most Productive Authors in the World' in the area of Mobile Commerce in 2019. In 2020, he was acknowledged by Elsevier's Scopus and Scival as one of the Top 10 Malaysian Authors and High Impact Researchers in 'Technology Acceptance Model; Mobile Payment; UTAUT'. Scopus's information also shows that his work has been cited over 7 times the world's average suggesting the attractiveness of his papers in accumulating citations.

Despite his busy and hectic schedule, Dr Garry has reviewed over 566 manuscripts indexed in Clarivate Analytics (SSCI; SCI; SCIE; ESCI) and has been awarded the Outstanding Reviewer for the Journal of Industrial Management and Data Systems (Emerald) and Internet Research (Emerald) in the 2016 and 2019 Emerald Literati Network Awards for Excellence. He was the recipient of the 2017 and 2018 Publons Global Peer Review Award, 2019 National Outstanding Reviewer by Private Education Co-operative Malaysia (with support from Emerald Publishing, United Kingdom and The Ministry of Education, Malaysia) and the Top Reviewer Award in 2020 by Sustainable Production and Consumption (Elsevier). He also sits as the editorial board for renowned journals such as Industrial Management and Data Systems Tourism Review International Journal of Bank Marketing, Internet Research, Journal of Financial Service Marketing, International Journal of Information and Management, etc.

Dr Tan's work has appeared in Expert Systems with Applications, IEEE Transactions on Engineering Management, Journal of Retailing and Consumer Services, Computers in Human Behavior, International Journal of Information Management, Tourism Management, Technological Forecasting and Social Supply Chain Management: An international Journal, International Journal of Production Research, etc.

Further attesting to his academic commitment and achievements, Dr Tan is currently the Visiting Professor at School of Finance and Economics, Nanchang Institute of Science and Technology, China and was also the former SiRC Visiting Scholar at Nanyang Technological University (NTU), Singapore from 2013-2014. He has also been appointed as co-consultant to projects covering Thailand, Singapore and Malaysia.

While his research journey has been colourful, Dr Tan has always been grateful to his former PhD supervisor, Professor Dr Ooi Keng Boon who mentored him since he was a young researcher. "His dedication, enthusiasm and optimism are truly inspirational and because of his invaluable guidance, I have not only grown as a person but have also cultivated a love for research. I always remember his saying that you need to sacrifice and work hard if you want to succeed in life," he said.

HUMAN GENETICS AND HEALTHY AGING

Associate Professor Dr Farahnaz Amini

Associate Professor Dr Farahnaz Amini is a public health geneticist with 20 years of working experience in Iran, Dubai, and Malaysia. After her early work with single-gene disorders, which equipped her with extensive experience in analysing genome variations in human diseases, now her interest is to understand the interplay between the DNA and external forces that influence individual risks for disease. In light of this, her team is currently investigating the effect of environmental factors and lifestyle on DNA and telomere integrity among healthy populations and breast cancer patients. In 2016, she was among the recipients of UCSI's Top Researcher Award and Promising Researcher Award for her research achievements and contributions. She has received several national grants as co-PI and one FRGS as PI in 2017.

Dr Farah graduated with a Bachelor's in Biology from the University of Tehran, the oldest existing university in Iran. It is also one of the most prestigious universities in the Middle East. Admission to the university's renowned undergraduate and graduate programmes is very competitive. Dr Farah was among the top one percent of students who passed the national entrance examination administered yearly by the Iranian Ministry of Science, Research and Technology. She migrated to Malaysia in 2003 to continue her studies. She graduated with a Master of Science (MSc) in Biochemistry and a Doctor of Philosophy (PhD) in Genetics from Universiti Kebangsaan Malaysia. She was recognised as one of the excellent graduate students in her second semester pursuing her MSc. She was working on *Plasmodium falciparum's* gene expression patterns and was awarded the UKM ZAMALAH scholarship.

Associate Professor Dr Farahnaz Amini
PhD Genetics, MSc Biochemistry

Dr Farah was the first Iranian who obtained a scholarship from the Ministry of Higher Education Malaysia, known as the Malaysian Technical Cooperation Programme (MTCP), for her PhD in 2007. "Becoming a scientist presents the opportunity to positively impact my community and the larger society I live in," Dr Farah said. "It was the reason that I aspired to do my PhD project, striving to serve the underprivileged group of aboriginal people (Orang Asli) in Malaysia, known as Negrito." It took many trips and extended stays in different villages to study the genetic basis of a disease known as G6PD deficiency. After her degree, she was accepted into an international training programme at Pasteur Institute, one of the oldest leading research and public health centers in the Middle East. During her training, she was working in the Department of Medical Parasitology under the supervision of Professor Mehdi Asmar working on Cutaneous Leishmaniasis.

She was also a research fellow for nine months in a World Health Organization collaborative centre for research and training in cardiovascular disease control, prevention, and rehabilitation of cardiac patients in the Eastern Mediterranean Region. Her endeavours in this centre continues to contribute to her ongoing research and collaboration with the team has produced a few scientific publications.

Her passion for teaching started while she was still an undergraduate student. Dr Farah worked in the Ministry of Education, Tehran, Iran as the Director of Central Biology Laboratory for three years. Then, she joined the University of Social Welfare and Rehabilitation Sciences in Tehran in 1994, where she and her colleagues founded the Genetic Research Center (GRC) in 1997, a research and diagnostic lab and the only national referral prenatal diagnostic lab. In GRC, she served as the Cytogenetic Lab Supervisor for six years before moving to Malaysia for her postgraduate studies. Alongside others, she founded the Iranian Human Mutation Gene Bank, a data and sample resource for worldwide collaborative genetics research in 2003.

Dr. Farahnaz serving the underprivileged group of aboriginal people (Orang Asli) in Malaysia, known as Negrito.

Since early 2014, Dr Farah has collaborated with Nottingham Campus Malaysia. The first project was entitled "Developing a model for an intervention programme for weight management in overweight and obese Malaysian adults in the presence of gene variations." This project investigated the modulatory effect of gene variants on the post intervention differences in obesity-related anthropometric and metabolic traits after 6 months of dietary intervention.

Being part of the School Of Healthy Aging, Medical Aesthetics, and Regenerative Medicine at UCSI, Dr Farah is also interested in the molecular mechanisms of skin aging.

Her team is interested in identifying pathways involved in delaying skin aging in response to external stimuli, such as Pharmacological Inhibitors of the HIPPO pathway. She also seeks to understand the mechanisms that influence the rejuvenation of skin cells; in early 2020, she began a collaboration with Manchester University in the UK with Professor Dr Delvac Oceandy.

As an academician and scientist working with medical doctors, Dr Farah hopes to obtain more tangible outcomes through her teaching and research. She is hoping to train her students to practise evidence-based medicine, conduct research with precise practical applications, as well as have a long-lasting impact on their patients' health and well-being once they graduate from UCSI University. "I would like to play a part in inducing impactful, positive change in the long-term practice of medicine", Dr Farah concluded.

MIMOTOPES CANCER VACCINE: LEARNING OF USING IN SILICO-BASED APPROACH TO LOOK FOR THE HIGH IMMUNOGENECITY CANCER VACCINE

Dr Siak Pui Yan

Post-Doctoral Research Fellow in the Faculty of Medicine and Health Sciences

Introduction

Cancer vaccines are designed based on one or more Tumor-Specific Antigens (TSAs), and can be categorised into prophylactic and therapeutic vaccines based on its clinical intention (1). The former are administered prior to tumor development to circumvent immunosuppression against cancer and is directed at individuals with pre-malignant lesions or increased genetic predisposition (genetic or familial) to develop certain cancer types. Therapeutic vaccines on the other hand, are administered following diagnosis to strengthen anti-cancer immunity by helping immune cells to recognise existing cancer cells as non-self, thus reducing tumor growth prior to surgical intervention (2-5).

All types of cancer vaccines have been explored extensively as a promising treatment for cancers with the goal of prolonging cancer patients' overall survival rates and hoping to cure patients. However, the efficacy of the vaccine majorly relies on the specificity of the Tumor Associated Antigens (TAAs) or TSAs used. Since the self-TSA or -TAA infiltrating lymphocytes are the T-cells that were removed or destroyed from negative selection in the thymus, therefore only suboptimal responses are elicited and owing immunotolerance (6). Hence, the vaccines must be designed or modified to have the ability to overcome the immunotolerance and effectively stimulate strong Cytotoxic T Lymphocytes (CTL) effector response to attack tumors.

In the last decade, an alternative approach using modified peptide variants, also known as mimotopes, has been explored to potentially induce enhanced epitopes-specific antitumor T- or B-cells responses (7). Mimotope is a peptide mimicking the epitope of an antigen that allows binding to the paratopes of antibodies (8). Mimotopes are also capable of inducing secretion response-specific cytokines, stimulating production of antibodies, having superior MHC-restriction capabilities and potentially developing immunological memory against targeted TAAs or TSAs (9).

As synthetic mimotopes are not identical to natural epitopes, this characteristic may be the key in overcoming immunotolerance of tumor antigens (10). Essentially, such molecular mimicry now allows mimotope vaccines to induce CTL and antibody responses that can bind to the natural antigen on tumor cells, thus opening the flood gates towards B- and T-cell anti-cancer responses (11). Numerous mimotopes vaccines have been developed, please look into references (12-16) for more details.

Application of in silico-guide modification sequence

To overcome the poorly immunogenic peptides in vaccine design, sequence modification can be performed. Amino acid substitution at anchor residues of the peptide epitope aims to increase Human Leukocyte Antigen (HLA) binding affinity to the Major Histocompatibility Complex (MHC) class I molecules and enhance stimulation of T cell receptor (17-20), and such modification has been associated with improved immunogenicity in vivo (21-24).

In silico-guided modification of epitope sequences allows predictive discrimination of those that may be potentially immunogenic before subjecting them to in-depth studies. Therefore, only candidates predicted with high antigenicity will be selected, constructed, and tested in the lab. The antigenicity prediction is based on T-cell epitopes (MHC class I/II binding) and B-cell epitopes (hydrophilicity, surface accessibility, antigenicity, and linear epitope) (11). Using a scoring and ranking system based on these parameters can help to shortlist the potential mimotope candidates for further development as peptide cancer vaccines (11). General overview of in silico-guide modification of epitope sequence will be discussed according to study 11 and 25.

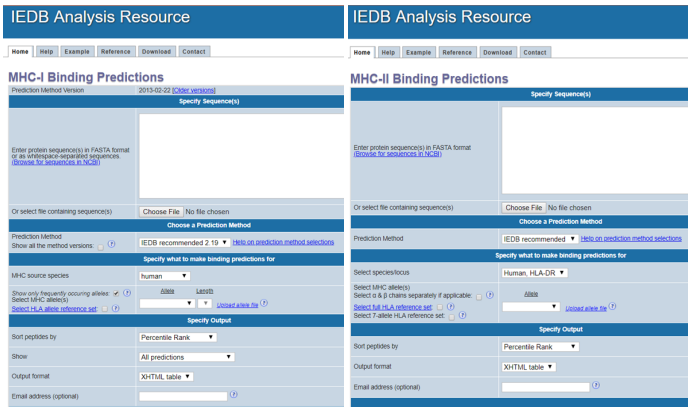

Figure 1. IEDB web server for MHC class I and II binding prediction (25).

Modification of target peptide with amino acid substitution

The peptide sequences can be modified by adding single amino acid substitutions with up to 20 different amino acid possibilities. Use all query sequences generated for the subsequent T- and B-cell epitope predictions (11). Figure 1 shows the Immune Epitope Database and Analysis Resource (IEDB), which is a tool to predict and assess the properties of T- and B-cell epitopes. When it comes to understanding and selecting of potential T-cell epitope, the MHC class I/II epitope predictions will be the main focus. T-cell epitope prediction against both human and mouse or rat libraries are important in order to generate predictive values of each modified peptide sequence during in vivo assessment. Human MHC class I epitope predictions include HLA-A/B/C alleles, while HLA supertypes (34 allelic subtypes) cover highly polymorphic HLA-DP/DQ/DR MHC class II alleles. On the other hand, mouse MHC class I epitope predictions cover H-2D, H-2K and H-2L alleles, while predictions for MHC class II are focusing on H-2I allele (11).

The predicted output is given in units of IC50 nM. Peptide sequences with low percentile ranks are considered good MHC class I/II binders. In each MHC class binding prediction results, the peptide sequences will be categorised into high, intermediate and low binders based on the percentile rank.

Prediction of linear B-cell epitopes and hydrophilicity stretches can be done by using BepiPred method which uses the combination of a hidden Markov model and two amino acid propensity scales: the Parker's hydrophilicity scale and Levitt's secondary structure scale (26-28).

Hydrophilicity scale used in the Parker's hydrophilic prediction is based on the calculation of peptide retention times in High-Performance Liquid Chromatography (HPLC) with a reversed-phase column. The more hydrophilic the peptide fragment, the higher the retention time in HPLC (27). Kolaskar and Tongaonkar antigenicity prediction is using a semi-empirical approach developed based on physicochemical properties of amino acid residues to predict and score mimotopes on segments within a protein sequence that are likely to be antigenic enough for Antigen Presenting Cell (APC) recognition (29, 30).

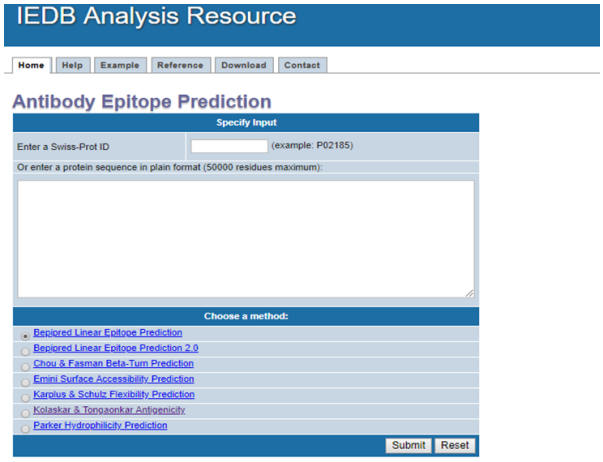

Figure 2. IEDB web server for B-cell epitopes prediction (25).

Emini surface accessibility prediction is using a scale that suggest hexapeptide mimotope regions for surface accessibility of the epitope being bound on the surface of APCs. Aside from T- and B-cell epitope predictions, RNA secondary structure prediction needed to be performed to understand the structure of the unknown or modified peptide. CentroidFold is a web server which can be used to predict the RNA secondary structures with γ-centroid estimator based on the base pairing probability matrix.

Similar to T-cell epitopes except RNA secondary structures prediction, each query sequences will be categorised into high, intermediate or low based on the respective scores. For the results of RNA secondary prediction, the RNA sequences are only categorise as either loop forming or non-loop forming

Scoring and ranking system

A scoring and ranking system is established after obtaining the predicted raw scores from all seven parameters. All parameters are assigned with reduced score ranges in accordance with decrease in priority: peptides having high MHC class II restriction > MHC class I restriction > surface accessibility > hydrophilicity > antigenicity > epitope linearity > RNA secondary structure. Generally, MHC class II epitope prediction is chose as the first priority in the peptide immunogenicity ranking system due to its important role in eliciting Th-1 (cell-mediated response) and memory-based T-cells responses. As shown in Table 1, a range of score percentages for parameters used in T-cells epitope prediction is assigned with a total up to 100%. Similarly, a range of score percentages for parameters used in B-cells epitope prediction is also assigned. Next, each predicted raw score obtained will then be converted to the score percentage for each immunologic parameter. Total normalised percentile scores yielded create a series of ranked mimotopes in descending order of immunogenicity. The higher total percentage score indicates that peptide sequence has higher antigenicity. Epitope sequences that may be potentially antigenic can then be shortlisted, synthesised, and subjected to further development studies or pre-clinical assessments in order to evaluate the immunogenicity. Example of normalised scoring range for all prediction parameters is shown in Table 1 (11).

Parameter (max. weightage)	Raw score range for conversion (max. weightage (%))		
	High	Intermediate	Low
MHC class II (58%)	0.01–4.65 nM, (58%)	4.66–9.28 nM, (39%)	≥9.29 nM, (20%)
MHC class I (42%)	0–50 nM, (42%)	51–500 nM, (28%)	501–5,000 nM, (14%)
SA[a] (34%)	2.531–3.149, (34%)	1.913–2.530, (23%)	1.294–1.912, (12%)
HY[b] (29%)	3.444–4.614, (29%)	2.615–3.443, (19%)	0–2.614, (9%)
AT[c] (19%)	≥1.0, (19%)	<1.0, (13%)	*N/A*
LE[d] (12%)	≥5.82, (12%)	0.36–5.81, (8%)	0–0.35, (4%)
RNA 2°[e] (6%)	Does not form hairpin loop, (6%)	*N/A*	Forms hairpin loop, (4%)

N/A, Not applicable; [a]Surface accessibility; [b]Hydrophilicity; [c]Antigenicity; [d]Linear epitope; [e]RNA secondary structure.

Table 1. Example of predicted in silico raw score conversion scheme for each immunological parameter (11).

Prospect

For future advancement in T-cell and B- cell epitope prediction, the design of peptide should involve more MHC alleles to cover broader MHC polymorphism, so that the vaccine can be used to target larger population. Moreover, applying more comprehensive in silico approaches and predictions of other parameters and scoring methods can further improve the accuracy and precision of T- and B-cell epitope predictions. Besides that, the antigenicity of mimotope vaccine can be further enhanced by attaching with a carrier protein such as keyhole limpet haemocyanin and tetanus toxoids which contain universal T-cells epitopes.

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INAUGURAL DOCTORAL SUPERVISION WORKSHOP

UCSI University conducted the first Doctoral Supervision Workshop virtually on 19 December amid the ongoing COVID-19 pandemic. Research is imperative for Malaysia to achieve its overarching goal of becoming a developed nation with an inclusive, sustainable, and resilient society. Indeed, the central challenge towards the attainment of this goal is the establishment of a scientifically advanced and progressive society. This challenge underscores not only the important role of Science, Technology and Innovation (STI) but also the role of universities.

Postgraduate driven research is one of the major contributors towards this goal. UCSI University has long recognised this with the establishment of the Office of Postgraduate Studies (OPS) in 2010. Postgraduate students are the engine directly driving much of the technological advancements in Malaysia. Beyond developing the expertise and skills required to engage in research, postgraduate research programmes also enhance critical thoughts required for a healthy democracy. The importance of a functioning democracy to make good public health decision is very apparent currently.

In 2020, UCSI University successfully increased its postgraduate student body by 300%. This shows that despite the pandemic, there are many that still recognise the importance of postgraduate studies and research. The Doctoral Supervision Workshop was proposed by Academician Senior Professor Dato' Dr Khalid Yusoff to enhance the experience of our research students and the quality of our doctoral graduates.

During the five-hour workshop, prominent fellows of Academy of Sciences Malaysia, Malaysia's top scientific body, were invited to share their experience. Fellows that spoke at the workshop included Senior Professor Dato' Dr Khalid, Professor Dr Phang Siew Moi, Professor Dr Kurunathan A/L Ratnavelu and Professor Dr Ong Seng Huat. The speakers shared on various topics of identifying research niches, monitoring postgraduate students, helping them publish and taking care of the emotional well-being. The workshop came to a close with a forum moderated by Professor Dato' Dr Ahmad bin Ibrahim.

In 2012, Malaysia has became one of the top 15 most competitive economies in the world based on the World Competitiveness Yearbook. The country is now aiming to be among the top 10 and UCSI University is proud to be training up the next generation of competitive leaders.

Senior Professor Dato' Dr Khalid Yusoff imparting his experience to participants during the workshop.

Professor Dr Phang Siew Moi advocating for a vibrant research culture in UCSI University.

CURRENT RESEARCH GRANT CALL

No	Funding Scheme	Submission Closing Date
1	REIG 2021-1 Cycle	**15 February 2021**
2	GCRF UKRI-JST-DOST Research Collaborations in South East Asia	**10 February 2021**
3	TÜBİTAK and MIGHT Call for Proposal on Post COVID-19 Impact	**12 February 2021**
4	2021 LPPKN Research Fund	Submission to CERVIE for evaluation: **5 February 2021, 6.00 noon** Submission to CERVIE for endorsement: **11 February 2021, 12.00 noon** Submission to LPPKN: **15 February 2021, 5.30 pm**
5	Research and Innovation for Global Health Transformation (RIGHT) Programme – 4th Call	Mandatory Intent to submit: **1.00pm UK time on 10 February 2020** Submission date: **1.00pm UK time on 10 March 2020**
6	Prototype Research Grant Scheme, PRGS	**26 February 2021**
7	Fundamental Research Grant Scheme, FRGS	**31 March 2021**
8	Global Health Research Centres Call 1 - Research and Institutional Capacity Strengthening in Non-Communicable Diseases	**1.00pm UK time on 31 March 2021**
9	NIHR Global Health Research Units – 2nd Call	**1.00pm UK time on 18 May 2021**
10	NIHR Global Health Research Groups – 3rd Call	**1.00pm UK time on 18 May 2021**
11	Tech Planter ASEAN 2021	**30 April 2021**
12	Malaysia Toray Science Foundation 2021	**31 May 2021**
13	Malaysia Grand Challenge, MOSTI • Applied Innovation Fund (AIF) • Technology Development 1 Fund (TeD 1) • Technology Development 1 Fund (TeD 1) • Bridging Fund (BGF)	**Open, no closing date as for now**

Please refer to your respective Head of Research for more information.

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