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# THE FUTURE OF MEDICAL RESEARCH

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In this newsletter, we look into how LKCMedicine will prepare and contribute to the future of medicine through Artificial Intelligence (AI) and Robotics to provide better elderly care.

# STRIDES

The Research Newsletter of Lee Kong Chian School of Medicine



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### FROM THE VDR'S DESK THE FUTURE OF MEDICAL RESEARCH

by Vice-Dean Research, Professor Lim Kah Leong



Vice-Dean Research, Professor Lim Kah Leong

I am delighted to launch the inaugural quarterly research newsletter, "STRIDES", which celebrates the research achievements of our medical school. As we endeavour towards achieving transformative research at LKCMedicine, it is important for us to recognise the efforts of our faculty, research staff and students, as well as our collaborators who have been working hard to support our cause. I am pleased that "STRIDES" provides a platform for us to do that.

In this inaugural issue, we highlight an important initiative led by our Dean, Professor Joseph Sung, on using Artificial Intelligence (AI) and Robotics technology to improve the health and wellness of our elderly. Through his leadership, LKCMedicine has linked up with various Nanyang Technological University schools and also the National Healthcare Group to develop technologyenabled solutions for elderly care. Besides this, we also feature key scientific as well as innovation and enterprise achievements of our School.

During these challenging times of COVID-19, I hope that the articles in this newsletter would lift the spirits of the School's research community as we honour your scientific excellence and innovations. Indeed, we have much to celebrate and I am personally proud of our School's achievements in research, innovation and enterprise.

Let me end by thanking the editorial committee (especially co-chairs Dr Andrew Ang and Sufian Suderman) for their hard work and commitment in putting this inaugural issue together. I find the name that they have given to the newsletter, i.e. "STRIDES", particularly meaningful as it encapsulates the progressive steps that we are collectively taking one at a time towards realising our objective. While doing this, let us also remember to always take things in our stride.

When the science is right, everything will fall into place.

Enjoy reading!

### A TECHNOLOGICAL JOURNEY TO THE HEART OF ELDERLY CARE

**by Sufian Suderman** with contribution from Max Cheung



#### **KEEPING A CLOSE EYE ON AI**

In 2014, Prime Minister Lee Hsien Loong launched the SMART Nation initiative and described Singapore as a nation "where we can create possibilities for ourselves beyond what we imagined possible." Seven years on, various healthcare and academic institutions including Lee Kong Chian School of Medicine (LKCMedicine) have heeded the Prime Minister's clarion call to develop technologies that will empower people to live meaningful and fulfilled lives. Moreover, Singapore is currently facing an increasingly ageing population and the SMART Nation initiative would enable and encourage senior citizens to lead independent lives through the development and use of Artificial Intelligence (AI) technologies and Robotics in their daily routines.

To achieve this outcome, under the leadership of LKCMedicine Dean Professor Joseph Sung, the School has embarked on strategic initiatives with other Nanyang Technological University (NTU) Schools and Colleges, as well as with the National Healthcare Group (NHG). These initiatives will harness all initiatives on AI technologies and Robotics to enhance healthy ageing and improve clinical outcomes. Prof Sung noted that there will be hurdles in the implementation of advanced technology especially amongst the elderly. He underscored the importance of adopting an interdisciplinary approach involving academics from other disciplines such as business and social sciences to better present and market the usefulness of AI and Robotics to the elderly as well as their caregivers.

#### MAPPING THE BLUEPRINT FOR BETTER ELDERLY CARE

Despite the immense enthusiasm shown by the research community for AI and Robotics, very few ideas were translated into clinical practices. Recent studies have shown that a majority of the research remained as observational. There were only 37 randomised controlled trials, the gold standard of clinical research, conducted to examine whether artificial intelligence could be applied in clinical practices.

The effectiveness of AI and Robotics has remained like the mysterious "black box". Hence, it is necessary to have a better understanding of AI and Robotics to develop beneficial tools in caring for the elderly. Unravelling the intricacies of these technologies will help to better map appropriate elderly care and in turn, provide tangible data on the efficacy of such technologies.

Once the effectiveness of AI and Robotics has been established and communicated extensively, it would encourage the widespread adoption and acceptance of AI and Robotics by both healthcare providers and patients, especially the elderly who are more likely to resist changes in their lifestyle and perspectives.

Kick-starting the initiative, Prof Sung has identified four domains affecting the quality of life for the elderly that can benefit from AI and Robotics research:

- Frailty
- Cognition
- Mental Wellness
- Connectivity

To achieve this outcome, it is important to find the right people who are the right fit to do right by the trust given by the public in providing directions and solutions to improve elderly care.

#### ASSEMBLING THE AI-R TEAM

LKCMedicine has built a multidisciplinary team comprising NHG clinicians and NTU faculty members from the Engineering, Humanities & Social Sciences and Business schools. It has convened two Artificial Intelligence – Robotics (AI-R) workshops, the first in April 2021, organised



LKCMedicine Dean Prof Joseph Sung, Senior Vice President (Health and Life Sciences) & Distinguished University Professor, NTU Singapore



Prof Lam Khin Yong, Senior Vice President (Research), NTU Singapore



Assoc Prof Chin Jing Jih, Chairman, Medical Board, Tan Tock Seng Hospital & Central Health



Prof Lim Kah Leong, Vice-Dean (Research), LKCMedicine



NTU Singapore faculty and NHG clinicians at the AI-R workshop

with the NTU College of Engineering, and the second in August 2021 with the NTU Institute of Science and Technology for Humanity. These two workshops provide a platform for networking and charting the road ahead in AI-R research.

At the workshops, participants gathered to discuss how to develop affordable and easy to use AI-R applications that are trackable and provide clinical data for the following areas:

- Maintaining elderly's physical fitness (Frailty)
- Preservation of cognitive power and memory in the elderly (Cognition)
- Enhancement of worthiness and meaning of life among the elderly (Mental Wellness)
- Promoting connection between the elderly and society and healthcare providers (Connectivity)

Professor Lam Khin Yong, Senior Vice President for Research, NTU Singapore, said interdisciplinary

collaborations can help the university's progress towards the NTU2025 goals and his views were echoed by Associate Professor Chin Jing Jih, Chairman, Medical Board, Tan Tock Seng Hospital & Central Health, who emphasised how clinician-scientist collaborations can serve to resolve healthcare needs in an emerging ageing population.

#### THE ROAD AHEAD

In tandem with Singapore's Smart Nation initiative, AI-R will open up new possibilities in elderly care that will see interdisciplinary collaborations from medical technologies to humanities. It is important to establish the usefulness of AI-R through rigorous and peer-reviewed academic research, paving the road for safe implementation and eventually, widespread adoption that will significantly improve elderly care for both patients and healthcare providers. AI-R could also restore a sense of dignity in the elderly as these technologies have the potential to help them lead meaningful yet independent lives, thus providing a healthy ecosystem of support with family, friends and the community so that they can live their golden years to the fullest.

# LKCMEDICINE FACULTY LISTED AS TOP 2% OF THE MOST-CITED SCIENTISTS (CAREER-LONG CITATION IMPACT)

In the latest update by Stanford University on sciencewide author databases of standardised citation indicators\* published in PLOS Biology, LKCMedicine faculty has been listed as the top 2 per cent of the most-cited scientists in the career long citation impact category! Congratulations!

Reference: \*Baas, Jeroen; Boyack, Kevin; Ioannidis, John P.A. (2020), "Data for "Updated sciencewide author databases of standardized citation indicators", PLOS Biology

### 2017



JOSEPH SUNG



GEORGE AUGUSTINE



JOHN CHAMBERS



MAURICE VAN STEENSEL



LIM KAH LEONG

**JOSIP CAR** 



LAURENT RÉNIA



### 2018



**JOSEPH SUNG** 



JOHN CHAMBERS



LIM KAH LEONG



PHILIP INGHAM



GEORGE AUGUSTINE



MAURICE VAN STEENSEL



JOSIP CAR



LAURENT RÉNIA

### 2019



JOSEPH SUNG



JOHN CHAMBERS



LIM KAH LEONG



PHILIP INGHAM



GEORGE AUGUSTINE



MAURICE VAN STEENSEL



JOSIP CAR



LAURENT RÉNIA



**HELEN SMITH** 







### LKCMEDICINE HOSTS EMBO@NTU SYMPOSIUM





LKCMedicine hosted the EMBO@NTU Mini Colloquium on 15 April 2021 in recognition of the contribution of NTU Singapore's University EMBO Investigators and to continue building upon the university's strong relationship with EMBO. The fully-subscribed hybrid event was held at LKCMedicine's Experimental Medicine Building Learning Studio, with about 100 members and researchers from various NTU Schools and healthcare institutions. LKCMedicine's Toh Kian Chui Distinguished Professor and EMBO member Professor Philip Ingham FRS opened the colloquium and highlighted the contributions of various EMBO members to the life sciences research landscape in Singapore. Following Prof Ingham's opening address, NTU President Professor Subra Suresh spoke on the importance of international cooperation in scientific research, while EMBO Director, Professor Maria Leptin, who joined from Heidelberg via Zoom, expressed her gratitude for NTU Singapore's engagement with EMBO.

# FIRST EMB OPEN DAY 2021 LAUNCHED TO GREAT SUCCESS

On 27 January 2021, LKCMedicine organised the Experimental Medicine Building (EMB) Open Day. The event aimed to introduce the School's state-of-the-art EMB core facilities and platform technologies to the wider research community. Held online and on-site at the Learning Studio and Seminar Room simultaneously, the Open Day was fully subscribed and attracted 65 faculty members and researchers from various NTU Schools and healthcare institutions.

In his opening address, NTU Senior Vice-President (Research) Professor Lam Khin Yong highlighted the importance of events such as the EMB Open Day as they encourage interaction leading to interdisciplinary collaboration between faculty as well as staff from different Schools and Departments at NTU. Overall, the EMB Open Day was well-received, with many indicating their interest in future collaborations with LKCMedicine researchers. The event ended with a tour of the EMB facilities.











# IN PARTNERSHIP WITH NATIONAL HEALTHCARE GROUP

Since 2020, LKCMedicine, in partnership with the National Healthcare Group (NHG), has organised a series of joint symposiums with a focus on various areas of research. With the key objective of improving day-to-day medical practice, this series of symposiums gather like-minded researchers and faculty members from both LKCMedicine and NHG to better understand the mechanism of diseases and find common ground for research and innovation.

LKCMedicine Dean Professor Joseph Sung, identifying that there is a need for more clinical trials in Singapore, convened the fourth Symposium in this series on 19 August 2021. He hopes to drive more interest amongst clinicians and researchers in conducting clinical trials in Singapore's research landscape. Through asking the right questions and provable direct solutions that answer these questions, Prof Sung believes that clinical trials can change the world for the better.

In light of the ever-evolving mechanism of diseases due to changes to lifestyle and the natural environment, the symposiums will spark motivation to engage more to delve in research and to leave a legacy that would benefit humanity. LKCMedicine faculty have also participated in another joint Symposium that focused on Population Health on 31 March 2021.



NHG-LKCMedicine Symposium on Population Health (31 March 2021)



NHG-LKCMedicine Symposium on Clinical Trials (19 August 2021)

# IN PARTNERSHIP WITH IMPERIAL COLLEGE LONDON

LKCMedicine, together with Imperial College London (Imperial), is constantly charting new courses in science through various research collaborations and discussions. Seeking to actively redefine medicine and transform healthcare, LKCMedicine and Imperial held four joint workshops in 2021. These are the LKCMedicine-MRC London Institute for Medical Sciences Workshop on 6 May 2021, the Health Consequences of Air Pollution' Workshop on 22 June 2021, as well as two Neuroscience Workshops on Imaging and Data Visualisation on 25 May 2021 and "Molecular Medicine" on 28 September 2021.

These workshops were well attended with over 100 participants from various healthcare and educational institutions, connecting researchers with complementary research areas and skills from LKCMedicine and Imperial, further boosting the firm partnership established about 10 years ago to greater heights.



LKCMedicine – MRC London Institute for Medical Science Workshop (6 May 2021)



Imperial - LKCMedicine Joint Neuroscience Workshop on 'Imaging and Data Visualisation' (25 May 2021)



LKCMedicine – Imperial Joint Workshop on Air Pollution (22 June 2021)



Imperial - LKCMedicine Joint Neuroscience Workshop on 'Molecular Medicine' (28 September 2021)

# 8TH ASIA PACIFIC PRIMARY CARE RESEARCH CONFERENCE

### 8TH ASIA PACIFIC PRIMARY CARE RESEARCH CONFERENCE 2021

Creativity and Excellence in Family Medicine 16 - 17 July 2021







On 16 and 17 July 2021, the 8th Asia Pacific Primary Care Research Conference (APPCRC), organised by LKCMedicine's Family Medicine and Primary Care, was held as a hybrid event. Led by Professor Helen Smith, this regional Academic Family Medicine conference is traditionally organised in rotation with the departments of family medicine within the colleges and universities in Singapore and Malaysia. The latest edition was hosted by LKCMedicine with the theme 'Creativity and Excellence in Family Medicine'.

The Conference was originally slated for July 2020 but was postponed due to the COVID-19 pandemic. The multidisciplinary conference brought together clinicians, educators and researchers who are at different stages of their careers. LKCMedicine is proud to have brought together an amazing group of researchers, with over 100 delegates from Australia, Hong Kong, Malaysia and Singapore to network and share their latest research projects and developments in primary care, especially in the Asia Pacific region. 8TH ASIA PACIFIC PRIMARY CARE RESEARCH CONFERENCE 2021 Creativity and Excellence in Family Medicine 16-17 July 2021







# TARIPH HOLDS SECOND WEBINAR AND NETWORKING SESSION WITH SINGAPORE THORACIC SOCIETY



In collaboration with Singapore Thoracic Society (STS), The Academic Respiratory Initiative for Pulmonary Health (TARIPH) held its second joint webinar on 12 June 2021. TARIPH is the national research platform that addresses respiratory health and diseases in Singapore, bringing together interdisciplinary teams that share common interests, it is also a platform for the exchange of ideas and development of sustainable relationships, providing an organisational framework for academic respiratory research.

The webinar series was established to promote research, knowledge and collaboration across the experts in respiratory community in Singapore. Prominent

international experts on lung health, Professor Don Sin, Heart Lung Innovation Director and Professor of Medicine, Centre for Health Lung Innovation, University of British Columbia, and Professor Ganesh Raghu, Director of the Centre for Interstitial Lung Diseases at the University of Washington Medical Center, received great acclaim on their lectures from more than 80 healthcare respiratory professionals and academic researchers across Singapore.

Despite the restrictions on physical interactions in 2021, the TARIPH–STS partnership has continued with an excellent event!

# PROLONGED IMMUNE RESPONSE MAY CONTRIBUTE TO POST-COVID-19 BLOOD CLOTS



LKCMedicine Nanyang Assistant Professor Christine Cheung's study, which was featured extensively in local and international media, found that COVID-19 survivors, particularly those with heart disease or diabetes, may have an increased risk of blood clots or strokes due to prolonged immune response.

The findings may help to explain why some COVID-19 survivors, so-called 'long-haulers', report lasting COVID-19 symptoms and why some of them experience strokes or heart attacks weeks or months after recovery. This study may also suggest potential strategies to help prevent these complications.



# DECISION MATRIX FOR AUTOMATED TRANSCRIBING PROGRAMS TO IMPROVE QUALITATIVE RESEARCH

Qualitative research relies heavily on accurately analysing interviews, and the analysis of interviews is easier when they are orthographically transcribed. However, the transcribing process can be costly since it requires copious amount of time to be done accurately. Fortunately, with the growth in machine learning, supported by advancements in artificial intelligence, various automated transcribing programs (ATP) are now available. To sieve through the numerous ATP options, a decision matrix was constructed by LKCMedicine's Family Medicine and Primary Care group to decide on whether we should go with one of the models. Ten popular ATPs were reviewed: Google Speech-totext, Otter.ai, Trint, Transcribo, HappyScribe, Verbit, TranscribeME, NVivo, Rev, and Transcribe. The ATPs were reviewed based on significant cost-savings when compared to engaging a human transcriber, while factoring in manpower time and cost. The Family Medicine and Primary Care group is now shortlisting the ATPs based on the current list and running more tests with regard to their cost-effectiveness before deciding on the suitability of using an ATP over traditional human transcribers.



### TWO LKCMEDICINE SCIENTISTS HONOURED AS EMBO GLOBAL INVESTIGATORS FOR THEIR OUTSTANDING CONTRIBUTIONS TO THE LIFE SCIENCES



From left to right: Nanyang Assistant Professor Xia Yun and Nanyang Assistant Professor Yasunori Saheki

LKCMedicine is delighted to announce that Nanyang Assistant Professors Yasunori Saheki and Xia Yun are two of nine life scientists to be selected as European Molecular Biology Organisation (EMBO) Global Investigators.

Asst Prof Xia represents the only female Investigator of the second cohort of the Global Investigator Network launched in 2019. The School whole-heartedly congratulates both Asst Prof Saheki and Asst Prof Xia on their appointments as they embark on their four-year tenure in January 2021. However, due to COVID-19, the duration has been extended by one year on top of the initial four-year tenure. Both Asst Profs Saheki and Xia have similar plans on how they hope to maximise the benefits of being EMBO Global Investigators. They intend to use this prestigious network to reach out to the European scientific community and other EMBO member countries for more opportunities to collaborate on research projects. Both of them are appreciative of the support from EMBO in fostering communication between scientists across regions, as well as the additional support in promoting various activities from their own laboratories and getting papers published in EMBO press journals.

# LKCMEDICINE FACULTY CONFERRED NHG RESEARCH AWARDS

The National Healthcare Group (NHG) announced the recipients of the NHG Research & Innovation Awards 2021 on 7 October. The awards presented at the Singapore Health and Biomedical Congress aim to recognise individuals and teams who have made outstanding contributions to improve health outcomes or delivery, as well as promote the spirit for continuous research and innovation. There are five categories: NHG Research Impact Award; NHG Healthcare Innovation Award; NHG Research Mentor of the Year Award; NHG Innovator of the Year Award and a new category for this year, NHG-LKCMedicine Clinician Scientist Award.

Congratulations to the following faculty!



### NHG - LKCMedicine Clinician/Clinical Scientist Award





A/Prof Jimmy Lee Regional Chief (North and Central) Senior Consultant, Department of Psychosis and Research Division



Professor of Cardiovascular Epidemiology President's Chair in Cardiovascular Epidemiology NTU/LKCMedicine

NHG Research Mentor of the Year Award



### NHG Research Impact Award



Dr Sanjay H. Chotirmall Assistant Professor & Provost's C Molecular Medicine NTIL// KCMedicine







Director & Senior Consultant Institute of Geriatrics & Active Aging Department of Geriatric Medicine



### RESEARCH AWARDS



#### ASSOCIATE PROFESSOR JOANNE NGEOW NMRC CLINICIAN SCIENTIST AWARD

Assoc Prof Joanne Ngeow has been voted by participants as the Best Speaker at the 12th Medicine Review Course, which saw a recordbreaking 700 online participants, for her insightful presentation on the topic of medical oncology. Held on 25 September and 2 October 2021, the Medicine Review Course, organised by the College of Physicians of Singapore from the Academy of Medicine Singapore, is the nation's premier medical education event for healthcare professionals on the latest updates and developments in all fields of Internal Medicine.

#### UNDERSTANDING TUMOUR PREDISPOSITION IN ASIA (UTOPIA) STUDY: FROM PATIENT-CENTRED RESEARCH TO THE CLINIC

Associate Professor Joanne Ngeow has won the NMRC-Clinician Scientist Award, further enabling her research group to extend their programmatic work in the testing for genes which have strong predisposition in causing cancer. The overarching goal of this project is to further their efforts to functionally characterise novel variants of unknown significance in tumour predisposition genes identified in Asian individuals. These insights may directly translate into clinical care and more importantly, the study has the potential to provide novel insights into the patho-mechanisms of tumorigenesis that can be exploited for disease prevention and therapeutics.



#### ASSOCIATE PROFESSOR SANJAY CHOTIRMALL NMRC CLINICIAN SCIENTIST AWARD

As part of World Lung Day on 25 September 2021, LKCMedicine would like to congratulate Assoc Prof Sanjay Haresh Chotirmall for being recognised as an Expertscape World Expert in Bronchiectasis. This recognition is conferred to the top 0.1% of scholars writing about Bronchiectasis over the past 10 years, a level Expertscape labels as "World Expert."

#### INDOOR AIR MICROBIOMES AS A GATEWAY TO EXPOSOME-GUIDED PRECISION MEDICINE FOR RESPIRATORY DISEASE

Associate Professor Sanjay Chotirmall has won the NMRC Clinician Scientist Award which aims to provide salary and funding support for selected outstanding clinician scientists which enable them to carry out internationally competitive translational and clinical research, to bring bench discoveries to bedside clinical applications. Assoc Prof Sanjay and his research group will study the composition of indoor air microbiomes within patients' homes and explore their influence on disease. Identifying this at a personal level (precision medicine) may provide an innovative treatment approach for lung disease focused on the home environment (such as air purification) as an alternative to expensive drug treatments (and their side effects), in turn, improving the understanding of lungenvironment interactions.







**PROF MAURICE VAN STEENSEL** NMRC CLINICIAN SCIENTIST INDIVIDUAL RESEARCH GRANT AWARD

#### SEBACEOUS GLAND BIOLOGY: WNT SIGNALING AS A THERAPEUTIC OPPORTUNITY

Professor Maurice van Steensel and his research group will for the first time study the role of WNT ligands in driving the formation of early acne lesions (blackheads). The study will investigate which of these WNTs and their regulators are relevant in activating sebaceous gland growth. Next, it aims to develop effective targeting methods to ameliorate this activation. Prof van Steensel believes that WNT pathway inhibitors may provide a novel way to treat acne vulgaris effectively, or even prevent the disease from occurring in the first place. Thus, this study will lay the foundation to improve the well-being and quality of life of people suffering from acne.



**PROFESSOR JOHN CHAMBERS** PRECISION HEALTH RESEARCH SINGAPORE (PRECISE) AWARD

Professor John Chambers has been appointed as Chief Scientific Officer for Precision Health Research Singapore (PRECISE), an entity under the Ministry of Health, established to administer and implement Singapore's National Precision Medicine (NPM) Strategy. Phase II of the SG100K programme, where LKCMedicine is a participant, kicked off in April 2021 and will analyse the genetics of 100,000 healthy Singaporeans, and another 50,000 more with specific diseases. The genetic data will be integrated with detailed lifestyle, environmental, and clinical data to yield valuable insights into factors that contribute to Asian diseases and conditions. With these insights, researchers and doctors could develop new approaches that will not only benefit patients in the short term but for decades to come.



### RESEARCH AWARDS



**PROFESSOR PHILIP INGHAM FRS** MOE TIER 3 GRANT AWARD

#### NEXT-GENERATION HUMAN ORGANOIDS: CHARACTERISATION, ISOLATION AND COMBINATORIAL RE-ASSEMBLY OF NICHE COMPONENTS

Over the past decade, in vitro generated organoids, have emerged as an alternative to classical animal models for studies of development, physiology and disease. Organoids are miniature organs composed of differentiated cell types that self-assemble into 3-dimensional structures reminiscent of their cognate organs. Crucially, they can be derived from human stem cells, making it possible to study human development and pathogenesis directly in a dish.

Despite impressive advances, current organoids have their limitations. Professor Philip Ingham's prestigious MoE Tier 3 funded programme aims to deepen our understanding of organoid biology and produce "next generation" versions that better emulate the real thing. The research will focus on the kidney: it will employ an array of cutting-edge techniques - including single cell multiomic analyses, high resolution imaging and high-throughput combinatorial screening - to identify all the niche components necessary for its development.

By reconstructing this microenvironment in vitro, the group will establish improved models of kidney development and disease, enhanced platforms for drug screening and the foundations for the development of organ replacement therapy.



#### **DR ANDREW ANG** NATIONAL DAY AWARD COMMENDATION MEDAL 2021

Director of Research Administration and Support Services Dr Andrew Ang was awarded the Commendation Medal for this year's National Day Award. The Commendation Medal which was instituted in 1996, is awarded to any person in the service of any organisation, association or body rendering services in the field of education, amongst other categories, who has distinguished himself through commendable performance and conduct, or significant efficiency, competence and devotion to duty.



# RESEARCH PUBLICATIONS





ASSISTANT PROFESSOR FRANKLIN ZHONG

#### STRUCTURAL AND BIOCHEMICAL MECHANISMS OF NLRP1 INHIBITION BY DPP9

#### NATURE

Together with Professor Chai Jijie's team at Tsinghua University, China, Nanyang Assistant Professor Franklin Zhong and his research group has made a landmark discovery that the enzyme DPP9 is able to inhibit the activation of an immune sensor protein NLRP1. Previous studies have shown that NLRP1 mutations cause skin inflammatory and cancer susceptibility syndromes via inflammasome activation. Asst Prof Zhong's work on DPP9 will pave the way for future research on skin disease and possibly, the development of targeted treatments.

#### STRUCTURAL BASIS FOR DISTINCT INFLAMMASOME COMPLEX ASSEMBLY BY HUMAN NLRP1 AND CARD8

#### NATURE COMMUNICATIONS

Asst Prof Franklin Zhong's group from LKCMedicine, together with Asst Prof Wu Bin, School of Biological Sciences and Dr Bruno Reversade, Genome Institute of Singapore, A\*STAR, made an important finding on how two immune sensor proteins known as NLRP1 and CARD8 are activated by inflammatory triggers by forming spiral 'filament' like structures. These findings provide structural insight on how these proteins are able to rapidly kick-start an inflammatory reaction. Asst Prof Zhong's study also reveals how highly specific signaling can be achieved by LEGO-like assembly of simple protein domains. These results pave the way to developing specific drugs to manipulate the immune system and prevent auto-immunity.



ASSOCIATE PROFESSOR SANJAY CHOTIRMALL

#### INTEGRATIVE MICROBIOMICS IN BRONCHIECTASIS EXACERBATIONS NATURE MEDICINE

Associate Professor Sanjay Chotirmall and his team have developed a novel framework through inter-kingdom microbiome analysis (that is coined "integrative microbiomics") to provide a more holistic view of microbial interactions in the lung. Integrative microbiomics is able to capture microbial interactions to determine the risk of clinical deterioration which is unappreciated by studying a single microbial group (i.e. bacteria, virus or fungi). As antibiotics are likely to target microbial interactions rather than individual microbes in this framework, this provides a paradigm shift in the understanding of respiratory infection.

## RESEARCH PUBLICATIONS



PROFESSOR GEORGE AUGUSTINE

#### A NEURAL CIRCUIT FOR EXCESSIVE FEEDING DRIVEN BY ENVIRONMENTAL CONTEXT IN MICE NATURE NEUROSCIENCE

Why do we sometimes eat too much? Even after we have eaten enough food to fuel our body, many people keep eating. Such overeating leads to obesity and a myriad of health problems. In both lab animals and human beings, overeating can be facilitated by environmental factors, but the underlying mechanisms are unclear.

A brain mechanism responsible for environmentally driven overeating was discovered by Professor George Augustine, and Martin Graf, a Postdoctoral Fellow in Prof Augustine's lab. Their work was done in collaboration with Dr Fu Yu, one of LKCMedicine's Adjunct Faculty who is also an investigator at A\*STAR and the leader of the project.

This team identified a specific population of neurons in the hypothalamus that are responsible for overeating. The hypothalamus is a part of the brain involved in many physiological functions, such as maintaining body weight, temperature, emotions, eating, and drinking. These particular neurons are active when the mice see treats such as chocolate. In addition, experimentally activating these neurons, by the use of optogenetic or chemogenetic techniques, caused the mice to overeat. The signal for overeating is provided to the hypothalamic neurons by other neurons within the hippocampal formation, a part of the brain involved in encoding spatial information as well as learning and memory.

These results are important because they shed new insights into the brain mechanisms responsible for eating disorders, such as compulsive eating and binge eating. Furthermore, the results demonstrate a behavioral strategy to eliminate overeating in mice. In the future, perhaps such procedures could be adopted to treat eating disorders in humans.

# WOMEN IN SCIENCE @LKCMEDICINE

LKCMedicine has launched a new initiative called Women in Science @ LKCMedicine (WIS). This initiative is aimed at empowering female researchers, creating equal opportunities and tackling barriers to support the new generation of women leaders in the field of science. It is also a part of a larger initiative by Nanyang Technological University (NTU) called Women @ NTU.

Women in Science @ LKCMedicine supports the following principles:

- To ensure equity, inclusion, diversity, and belonging in LKCMedicine's research communication spaces
- To promote excellence and fairness
- To nurture a culture of tolerance, support, and mutual respect

The WIS representatives will be planning several activities taking place later this year. These include training opportunities held in partnership with Women @ NTU and the NTU career office, interactions with clinician scientists from the National Healthcare Group, the launch of the WIS Distinguished speaker series, and the provision of childcare and travel subsidies for female academics attending overseas conferences or other engagements. CONVERSATIONS ON SINGAPORE WOMEN'S DEVELOPMENT



Organised by MCC

In Support of Support of Women





### WOMEN IN SCIENCE ACTIVITIES

#### MAY 2021

Conversations on Singapore Women's Development

Professor Helen Smith, Associate Professor Joanne Ngeow, Assistant Professor Marie Loh and Assistant Professor Christine Cheung participated in the "Conversations on Singapore Women's Development" hosted by Senior Minister of State Janil Puthucheary. This is an ongoing initiative by the Ministry of Culture, Community and Youth. Whilst Singapore women have made tremendous progress over the years with the support of the community and the Government, more can be done collectively to support, protect and uplift them in various aspects. Through these conversations, we hope to understand the aspirations of Singaporeans for our women, which will in turn help us to cultivate a better and more inclusive society.

#### JULY 2021

EMBO Laboratory Leadership Course

Spearheaded by Nanyang Assistant Professor Christine Wong, LKCMedicine hosted the EMBO Laboratory Leadership Course that aims to explore with participants their approach to leadership and use this insights to define for each individual how they want to lead and manage their research groups or teams. The ultimate goal of the course is to boost research performance with effective leadership. Handy insights into how team members work best together, how to identify and resolve barriers to efficient operations, as well as tips for effective hiring and interviews were discussed. This is the first ever EMBO Laboratory Leadership Course delivered for scientists in Singapore.

#### NOV 2021

Women in Engineering, Science, and Technology Conference Grant

The WiEST Conference Grant was established in 2018 and supported by the Julia & Ken Gouw Foundation, NTU's College of Engineering, College of Science and LKCMedicine, to facilitate networking and development opportunities for young female engineers and scientists to embark on their early careers. Recipients in this programme will receive a one-time Conference Grant of \$3,000 to cover registration and travel expenditures to attend a technical and bonafide conference in their respective fields. This year Women in Science @ LKCMedicine will support two awards aiming at female participants in their fourth year of PhD or in their early career (within two years of the award of PhD Degree).



# INNOVATION & ENTERPRISE



Research, Innovation and Enterprise (RIE) are key components in Singapore's strategy to develop a knowledge-based economy and in particular, an innovationdriven healthcare system. LKCMedicine has made Innovation and Enterprise (I&E) a part of its strategic vision and will strive to cultivate a research culture that promotes academic entrepreneurship alongside conventional metrics of scientific excellence. Last year, the School established the Office of Innovation & Entrepreneurship (OIE) to help researchers identify and develop opportunities to commercialise biomedical research.

#### GETTING DOWN TO BUSINESS: INNOVATION & ENTERPRISE IN LKCMEDICINE

During his talk on 28 July 2021, Associate Professor Yen Choo revealed OIE's findings on LKCMedicine's technology chart and pipeline. For industrial projects, he shared OIE's role in the sale of LKCMedicine COVID-19 Screening Lab and how OIE helped to identify a number of potential buyers and prioritised them in terms of synergy and value, articulated the value proposition and negotiated the principal terms. Lastly, Assoc Prof Yen shared on the four I&E execution strategies in LKCMedicine. These are:

- Put in place governance and organisations by creation of OIE, I&E leadership positions.
- Nurture an LKCMedicine innovation culture by interviews and discussions with faculty.
- Create a physical space for I&E in LKCMedicine, "Co11ab@Mandalay biotech incubator".
- Put in place initiatives and partnerships.

Assoc Prof Yen shared that I&E are key components of NTU2025 and cornerstones of Singapore's strategy to develop a knowledge-based economy. He also shared that in the past year, the LKCMedicine OIE has engaged its faculty to catalogue its innovation pipeline and explore strategies to increase I&E productivity.

### SILVER FACTORY: THE TRACIEX BREATHALYSER



Prime Minister Lee Hsien Loong taking a COVID-19 Breathalyser Test before Parliament Sitting on 26 July 2021. (Photo: Ministry of Communications and Information)

A spin-off company of the Nanyang Technological University, Silver Factory has recently invented a breathalyser (TracieX) that can accurately detect COVID-19 in two minutes. According to the inventors, Associate Professor Ling Xing Yi, Head of NTU's Division of Chemistry & Biological Chemistry and LKCMedicine Associate Professor Andrew Tan, the device can achieve a sensitivity of 95 per cent and a specificity of 97.8 per cent, hence receiving a provisional authorisation from Singapore's Health Sciences Authority on 27 May 2021.

The breathalyser's chip effectively traps and intensifies key molecules in the breath, namely volatile organic compounds. Based on the difference in the breath-based metabolite distribution captured on the chip, the device can then accurately inform if a person is infected with COVID-19 within two minutes. This new, rapid, and noninvasive test device will be gradually scaled up to replace current antigen rapid testing and will be deployed in the airport and used by security firm Certis. Silver Factory is also collaborating with the National Centre for Infectious Diseases (NCID), Changi Airport and Certis to improve the test further. More than 1,400 individuals were recruited for trials at NCID, Changi Airport Terminal 1, as well as two hospitals in Malaysia. Back in July 2021, Prime Minister Lee Hsien Loong and several Members of Parliament took the COVID-19 breathalyser test before attending the Parliament session.



# COMMUNITY TELEHEALTH SERVICES (CTS)



A snapshot of the CTS project booth at Punggol 21 Community Club

A team of LKCMedicine and Interdisciplinary Graduate Programme students have co-founded Community Telehealth Service (CTS). This is a reimagined public health model with an Asset-Based Community Development approach and has since been awarded The CoLab4Good Award for Service to Society 2021 on 30 August 2021.

The idea of CTS was first conceptualised by the team as a finalist at ideasinc 2020, a start-up accelerator program organised by NTUitive. "The COVID-19 pandemic has disrupted routine non-urgent health services and hence highlighted the need for convenient health monitoring. This paved the way for telemedicine as the new normal," said the founders. In addition, the CTS project has also received numerous supports including the NTU Graduate College Community Engagement Project, Young ChangeMakers grant of National Youth Council, and oscar@sg fund of Temasek Trust.

Together with the undergraduate medical students and community volunteers, the team integrated health and digital technologies and implemented telehealth booths in community locations to create a resilient ecosystem of care. The pilot programme was successfully launched at Punggol 21 Community Club from 9 January 2021 to 28 February 2021. Moving forward, the team is working with more community partners to implement CTS across Singapore as well as piloting public health research studies with NTU Ageing Research Institute for Society and Education (ARISE).

If you are interested to find out more about CTS, please contact Mr Wee Soon Keong @ WEES0021@e.ntu.edu.sg

### LEARN HAPPENINGS





In its first year of operations, LKCMedicine EArly Researcher Network (LEARN) achieved important milestones, thanks to the support of the research community and the administrative staff at LKCMedicine despite the difficulties the pandemic has created. LEARN's very first event was Beyond Academic Careers, where Associate Professor Yen Choo shared on the startup and the industrial world while Ms Christina Wee delved into intellectual property. Dr Bhuvana Raghavan talked about the regulatory and ethical aspects and Dr Andrew Ang touched on research administration.



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LEARN kicked off its Fireside Chat series with Associate Professor Yusuf Ali, Professor Helen Smith, Professor James Best and his successor Dean Professor Joseph Sung. In a setup that differs from the usual scientific

seminar, each of them shared personal anecdotes, achievements, setbacks, and what made them who they are today.





LEARN Grant Writing Workshop

Another important achievement for LEARN was the creation of a Grant Writing Workshop. Together with Professor Michael Khor, Professor George Augustine, Associate Professor Sanjay Chotirmall, Assistant Professor Marie Loh and Assistant Professor Sarah Langley, our research community learned how to craft proposals and what reviewers look out for in both grant applications and journal submissions.

LEARN will be launching a call for annual awards for Research Excellence, Mentoring and Community Service to celebrate outstanding contributions of the early career research community, including research assistants, associates and fellows. Please feel free to nominate your colleagues whom you feel deserve these awards! Keep an eye out for our upcoming announcements. Stay tuned for our upcoming LEARN Research Symposium, tentatively scheduled for mid-February 2022. LEARN will deliver more talks and workshops in the near future, in the hope of continuously contributing to the early researcher community and will keep making LKCMedicine a great place to work and explore science for the greater good of this world.



### LEARN GRANT CALL AWARDEES



Following LEARN's workshop, the first LEARN Grant Call was launched in March 2021, giving our research fellows a chance at clinching intramural funding for a research project. This includes the LEARN Grant of up to S\$30K and the LEARN Innovation Award of up to S\$4K which they can use to explore their ideas independently. With the contribution of several faculty members as reviewers, four winners were selected for the LEARN Grant and three for the Innovation Award:

### **GRANT WINNERS AND PROJECTS:**



LOUISA CHAN Generation of bat airway organoids to combat emerging infectious diseases



MARTIN GRAF Claustral activity and function during associative reward-learning



#### **OLIVER MELDRUM**

Translating the use of airway secretory lung organoids to predict the type and severity of pathophysiological changes in pulmonary function and sputum properties during respiratory infection



BILGE ERCAN

Detection of phase separated areas in the plasma membrane by the GRAM domain of GRAMD1b



SHIWEI CHEN The social basis of COVID-19 vaccines: A qualitative analysis of vaccination decision-making process in Singapore



THERESIA MINA Developing and Validating a computerised Macronutrient and Taste Preference Ranking Task in Multiethnic South East Asia



SHAIRAH BINTE MOHD RADZI

Investigating the efficacy of a multimodal 3DPrinted Bone marrow biopsy trainer for medical education

### GRADUATE STUDENTS NEWS



TAN JUN WEN

### MERSU SPECIAL PROJECTS GRANT AND ALIVE SERIOUS GAMES GRANT

Tan Jun Wen from Assistant Professor Sreenivasulu Reddy Mogali's laboratory is a joint-awardee, alongside Asst Prof Reddy, of the MERSU Special Projects Grant for their proposal titled "A Novel Digital Serious Boardgame to Facilitate Enjoyable and Efficacious Rehearsal and Reinforcement of Complex Medical Subjects - An Exploratory and Feasibility Study into Anatomical Education". The grant allows for the testing of a specially-developed digital serious boardgame that would facilitate efficacious and enjoyable rehearsal of difficult subjects. The findings are expected to aid in the development of game-based rehearsal tools or capstone assessments for medical students. Jun Wen is also a major contributor and joint awardee alongside Asst Prof Reddy and Tan Tock Seng Hospital's Dr Rinkoo Dalan, of the ALIVE Serious Games Grant for a proposal titled "A Novel Trainer-Trainee Model for Game-Based Rehearsal of Diabetes Management". This grant supports the development of a digital serious game that seeks to improve the efficacy of diabetes management rehearsal through the inclusion of a novel Trainer-Triainee model.



**CHIARA NADDEO** 

#### WINNER OF ILLUMINA RNA-SEQ RESEARCH GRANT

Chiara Naddeo from Associate Professor Yen Choo's laboratory won the "Illumina RNA-seq Research Grant" for her abstract that was submitted for the Illumina RNA Grant Programme. The grant includes support for the whole workflow involving free preparation, sequencing and analysis of five RNA samples of choice. This creates an opportunity to understand the basics of RNA-seq workflow and analysis from an expert and apply the same for any project of interest. Winning this grant has given Chiara a different perspective of her project and multiple prospects to further her research at LKCMedicine.

### GRADUATE STUDENTS PUBLICATIONS



**KASTURI MARKANDRAN** 

#### MN2+-PHOS-TAG POLYACRYLAMIDE FOR THE QUANTIFICATION OF PROTEIN PHOSPHORYLATION LEVELS

#### CURRENT PROTOCOLS

This publication provides a guideline for optimising and utilising Mn2+ Phos-tag gel technology to separate phosphorylated proteins from their unphosphorylated counterparts. It provides key insights into methods for careful sample preparation and experimental directions for determining the appropriate Phos-tag gel compositions, electrophoresis and western blotting conditions. This protocol has been used to successfully resolve phosphorylated proteins extracted from cardiac and skeletal muscles. The need for publishing this article arose from her difficult experiences in optimising gel parameters during Ms Kasturi Markandran's studies. Hence, she was determined to inform researchers about the pitfalls of the approach and to expedite the process of optimising Phos-tag gels for their research needs via this publication.



WEE SOON KEONG

#### GALAXY WORKFLOW FOR BACTERIAL NEXT-GENERATION SEQUENCING DE NOVO ASSEMBLY AND ANNOTATION

#### CURRENT PROTOCOLS

Advances in next-generation sequencing (NGS) technologies has enabled routine whole-genome sequencing of bacterial isolates for comparative genomics and molecular epidemiology studies. In our work, we developed a code-free bioinformatics protocol that allows researchers without computational background to assemble bacterial genomes and perform basic tertiary analysis from their sequencing data. The workflow runs on GALAXY, a user-friendly web-based platform that contains many pre-installed bioinformatics tools. Using NGS data as input, the workflow performs quality check, de novo assembly, genome annotation, prediction of antimicrobial resistance genes, and multi-locus sequence typing. This open-source pipeline allows documentation, parameterisation, sharing and facilitating replication, reuse, and reproducibility of both data and methods that is in line with the FAIR Data Principles - Findability, Accessibility, Interoperability, and Reusability.





# **IN CONVERSATION**





#### DR TEY HONG LIANG

Dr Tey Hong Liang, an Associate Professor at LKCMedicine and Head of Research Division and Senior Consultant, National Skin Centre (NSC), was first drawn to research after he had finished his speciality training in dermatology. There, he saw that the clinical care that was offered to patients was suboptimal and it had not improved significantly over many years. Subsequent to his research, he became actively engaged with innovation and enterprise activities, as they are a means to improving the clinical outcomes of patients. Since then, Dr Tey has made great strides in his research. A high number of patients and people in the population have experienced significant improvements due to the novel treatments that his team has developed. Patients and populations, both local and overseas, can now obtain treatments and better management for a wide spectrum of itch and sweat disorders. Dr Tey was awarded the inaugural NHG Innovator of the Year Award in 2020 for these endeavours. In addition, Dr Tey and his team also discovered the pathophysiology of chronic itch of unknown origin and demonstration of effective treatments for this prevalent disease with high morbidity.

In an exclusive interview with LKCMedicine, Dr Tey outlines his overarching aims, both as a clinician and an academic, to improve people's lives and advance healthcare in our society.

#### 1) What do you hope to achieve through your research?

We need to solve currently unsolved problems, and to treat currently untreatable diseases. How can we do that when our highly-capable predecessors have not succeeded? We need to acquire new skills beyond conventional professional demarcations, to acquire better equipment, and to approach problems from alternative angles with the walking of paths less trodden.

We need to see the continuum from science to clinical medicine, and to practise academic medicine. Traditionally, clinical and academic institutions operate separately, with different aims, practices and traditions. If we remain working in our professional silos, a clinical institution remains another clinical institution and an academic institution remains another academic institution. But with clinicians knowing science and scientists knowing clinical medicine, i.e. with the true practice of academic medicine, we can expect surprises in unanticipated areas.

#### 2) What has LKCMedicine provided you with in your research?

Supportive leadership in LKCMedicine to facilitate development of academic medicine with NHG, with access to research facilities and opportunities for training and collaboration. Beyond the tangible components, more significant is the provision of a nurturing environment that encourages the growth of clinician-scientists.

#### 3) Current or past projects with LKCMedicine faculty?

An area of my interest is Skin Imaging. I have previously started working with Professor Leopold Schmetterer, Scientific Director and Head of Ocular Imaging, Singapore Eye Research Institute, on building a multi-modal skin imaging machine which incorporates multiple technologies to overcome the shortcomings of each individual technology. Currently with closer links being developed between LKCMedicine and NSC, NSC clinicians are increasingly having more avenues to work together with LKCMedicine primary faculty members.

### 4) What were some of the challenges you faced in your research and how did you overcome it?

The main challenge for clinician-scientists is securing salary funding to do research for the long term. One long-term solution is to acquire and channel revenue from research, innovation and enterprise- enterprise activities in order to generate a sustainable source of funding for further such activities.

#### 5) Any advice for aspiring junior scientists?

Find your purpose and you will have a nuclear energy source powering you on from within. It doesn't really matter what you can do for yourself, but what you can do for others.

Synergy between LKCMedicine and NSC can form the foundation for academic medicine to develop and flourish in Singapore's dermatological fraternity. Such 'academicians' can better address clinical problems through research, innovation and enterprise, which downstream will provide sustainable mechanisms and platforms to perpetuate the process to solve bigger problems involving the population. With the building up of such capabilities, we can then be able to take on with confidence current and future challenges and adversities, most notably the problem of a rapidly-ageing population coupled with rapidly rising costs that have besieged us.

#### A PUBLICATION BY LEE KONG CHIAN SCHOOL OF MEDICINE

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