

MediCine

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**Living Better,
Longer:**
How Research Is Giving
New Life to Ageing

DOSSIER

Goh Keng Swee Foundation Gifts S\$1.2m

In support of medical education for financially disadvantaged NUS medical students.

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COVID-19 SPECIAL

COVID-19 Vaccination Phases or Passports: Special Rules in Special Times?

Thinking through policy measures in this new normal.

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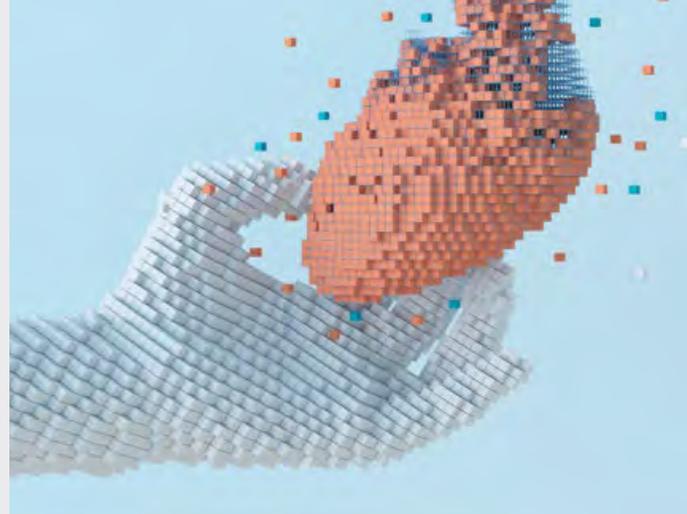
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Dean's Message

Dear Reader,

It is August 2021, and we are a year and a half into the pandemic. Much has changed, and much more change will come our way in the coming months as we learn to deal with the impact of the virus and adjust to new ways of living.

Amidst these unprecedented times, we welcome the Class of 2026. Medical and nursing studies for our newest students will be an experience unlike that of their predecessors'. But thanks to careful planning, blended learning, innovative pedagogies and creative technologies, we are able to make the learning journeys of our new students as enriching and fulfilling as that experienced by their seniors.

But what will the world be like by the time they graduate? While it is highly possible that COVID-19 may have been suppressed, or at least controlled, thoroughly by then with the arrival of next-generation vaccines and therapeutic treatments, what other pandemics are waiting to jump out of Pandora's Box? How do we ensure that tomorrow's doctors and nurses are equipped to meet the challenges that will surely be waiting for them? In this sense, nothing has changed. The study and practice of Medicine has evolved and developed in response to new needs, whether these take the form and shape of novel viruses or diseases that are a consequence of globalisation and our 21st century lifestyles, as well as the ever-widening effects of global climate change.

The Class of 2026, like those before and after them, will need courage, vision, compassion and drive to successfully handle the stresses and challenges that will be waiting for them. I see these qualities in this year's graduating classes of 2020 and 2021. They have come through a particularly trying 18 months, in which the pandemic



upended their clinical postings, killed off overseas attachments and programmes and plans, forced them into online learning sessions, and minimised social interaction. The Class of 2020 did not even have the opportunity to participate in the time-honoured tradition of receiving their degree scrolls on Commencement Day, so urgent was the need for their services. Along with the Class of 2021, the shared spirit of tenacity and compassionate devotion to duty in the face of uncertainty and highly stressful times is laudatory. Let me share the example of Dr Megan Loy, from this year's graduating class.

In her Phase III Paediatrics posting, Megan met a woman whose daughter had been warded for treatment. The mother's distress over her daughter's condition prompted Megan to reach out to the woman to reassure her that her daughter was being well looked-after. It was a small gesture that touched the woman profoundly. A few years later, in her final year of medical school, one of the House Officers on Megan's team turned out to be a relative of this woman. The House Officer recounted that the woman still spoke fondly of the kindness that Megan showed her. A comforting word and a listening ear—clear testimony of the impact that genuine compassion can have on the lives of patients and their loved ones.

The same spirit of compassion drove another alumnus, the late Professor Wong Hock Boon to devote his life to caring for people. Prof Wong graduated from the then University of Malaya in Singapore in 1952. He was offered the Founder Chair of Paediatrics in

1962 by the University of Singapore and was appointed Founder Director of the School of Postgraduate Medical Studies (now the Division of Graduate Medical Studies) in 1965. His devotion to the daily ward round with the Paediatrics department was legendary. Starting promptly at 7.30am every day, a gruelling 365 days a year, Prof Wong led a long train of paediatricians, trainees, and students through the wards, solving clinical problems for all patients, regardless of social class. Each day, immediately after the ward rounds, Prof Wong would jot down on a small piece of paper the difficult problems he had encountered on the ward rounds. He would then make his way to the medical library to research the latest advances on these clinical problems and write down his findings. This lifelong habit of continuous learning and teaching culminated in 52 volumes of the Paediatric Clinical Conference notes, wrote two of his former students turned colleagues, Dr William Yip and Prof Quak Seng Hock in a tribute to their teacher and mentor in March 2009. Besides his academic approach to the practice of paediatrics, Prof Wong campaigned vigorously to tackle childhood malnutrition and infantile diarrhoeal diseases, through the promotion of breastfeeding, aiming to improve the health status of children in the region. He pioneered the use of rice-water for oral rehydration in the management of acute gastroenteritis, and this enabled a new and highly cost-effective approach to diarrhoeal diseases in the developing world. His pioneering work on glucose 6 phosphate dehydrogenase (G6PD) deficiency in newborns resulted in a significant reduction in the incidence of kernicterus in Singapore and in the region. Prof Wong passed away in December 2008.

Two alumni of the School, generations apart, but linked by an enduring common compassion to provide the best of care for others. This is the DNA of the School that has energised every generation of NUS Medicine students.

Yours sincerely,

Yap Seng

MediCine

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NUS Yong Loo Lin
School of Medicine

Walking in Their Shoes

BY KOH YE KAI, NICHOLAS, PHASE II MEDICAL STUDENT

In light of the COVID-19 pandemic as well as circuit breaker measures imposed throughout Singapore from April to June 2020, the healthcare and social needs of marginalised communities were brought even more to the fore. People were urged to stay at home and only leave their residences for “essential activities”. The chatter and buzz on the streets of Singapore faded into an eerie quiet. For some communities living on the fringe, adjusting to the “new normal” became a new reality they had to face and tackle.



It was in this context that we—Phase 1 NUS Medicine students—embarked on a five-day “Medicine for the Marginalised” experiential learning journey (MMEJ) from 14 to 18 December 2020. This experiential programme was crafted and helmed by Associate Professor Tan Lai Yong for students to learn about the social determinants of health among vulnerable groups such as the homeless, elderly and former convicts.

Twenty-six medical students settled in at the Kampung Siglap Life Skills Training and Retreat Centre on our first day of MMEJ. The centre engages with displaced individuals and families to promote their well-being, by providing them with skills necessary for independent living. At the centre, Mel, founder of community dance group—Plus Point, candidly shared her life

experience as a former drug abuser, which resulted in her serving two terms in prison. She founded the dance group to provide teens with a sense of belonging, and to keep them away from a life of drugs and unhealthy habits.

Joined by two other dancers, Mel led the students on a socially distanced dance routine. It felt poignant to be part of the routine once I understood Mel’s perspective. For Mel, dancing is her way of coping with stress and to keep from straying back into her previous lifestyle. For me, Mel’s story illuminated the mental and emotional turmoil of an unstable family and social environment which led to unhealthy coping mechanisms, such as stealing, fighting and drug abuse—a story that resonated with many of her dancers at Plus Point. Stepping to the beat of hip-hop music

playing through the boom box, Mel danced on as we followed her energetic moves.

While Mel’s dance routine highlighted the ways in which art intersects and transcends social troubles, the night walk around Jalan Kukoh gave us an opportunity to experience how social architecture can shape community bonding. As an old public housing estate, Jalan Kukoh houses many rental flats—usually heavily subsidised—for individuals and families with no other housing options. We began the nights’ activities with a sharing session. Under whirling ceiling fans at Jalan Kukoh Food Centre, Mr Irza, a volunteer football coach, shares with us his experience coaching teenagers from lower income families at a street soccer court on the rooftop space above the Jalan Kukoh multi-storey carpark.



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medical students took part in the five-day “Medicine for the Marginalised” experiential learning journey from 14 to 18 December 2020

Much like Plus Point, football training is a way to engage teenagers from at-risk backgrounds—by nurturing a sense of belonging and encouraging meaningful time outdoors. We learnt that through Mr Irza’s guidance and motivation, the teenagers are empowered to explore their passions and develop self-discipline through the sport. After the session, Assoc Prof Tan guided us through the corridors and stairwells of Jalan Kukoh as well as the adjacent Chin Swee Estate, observing the sights and sounds of the neighbourhood, particularly the rooftop street soccer court at Jalan Kukoh. Towards evening, we interacted with the estate residents, had dinner at a food centre where residents commonly visit, and spoke to an artist who usually paints in Chinatown. Known for his paintings of famous Singapore landmarks, this artist sat outside OG Chinatown to paint the landscape there. We spoke about our shared interest, photography, and he shared more about himself. We left Chinatown for Read Bridge soon after, as I thought to myself that I would soon see him again, seated in another spot in downtown Singapore, focusing on his artwork.

The next day, we were treated to another morning of walking at East Coast Park. “Observe your surroundings carefully... what you see as well as what you do not see... the people who exercise and the people who eat at the food centre”, advised Assoc Prof Tan, before dismissing us, in groups of five, to explore the area. To the sounds of Chinese music played through speakers by elderly people practising *qigong* underneath ketapang trees, and the chatter of senior citizens heading home after a morning swim, we set off. My group struck up a conversation with a retiree seated on a stone bench at the edge of the parkland. Coincidentally, he shared with us how he used to serve as a general practitioner in the past when he lived in India, and how he now enjoyed mornings seated along the coastline as a retired doctor. We appreciated his advice for us as medical students and parted ways.

Another interaction which stood out to me was, getting to know a fisherman who had just returned with his fishing boat. Sharing how much the fishing scene has changed since the redevelopment of East Coast Park, the fisherman also recounted fond memories from the past as well as his love for being out at sea. Between our

chat with the fisherman as well as the retired doctor, I discovered how green spaces can serve to deliver positive social, mental and physical health for all. As a respite away from dense urban centres, green areas provide restorative and serene spaces for reducing stress, carrying out lifestyle activities, and improving social interaction and community bonding.

We ended our walk at East Coast Park with lunch at Marine Parade Food Centre. Between food, exercise and lifestyle activities, health and medicine, we learnt to appreciate the intricacies that define individuals’ well-being—the social determinants of health that relate to what we medical students will experience clinically. Indeed, where food is concerned, we were given an opportunity to get our hands greasy in an interactive session making roti prata back at Kampung Siglap Centre. Choosing healthier oil to make the roti prata, we appreciated the chance to learn how diet and nutrition are important factors in health and healthcare. At a point where health takes centre stage in an individual’s well-being, to what extent can healthcare alleviate and mitigate these risks?

MMEJ ended with a case-study discussion conducted by Dr Paul Ang, and other lecturers from Family Medicine. Students were invited to role-play as family members of a drug abuser to discover how our social circle and immediate environment can determine our habits and coping mechanisms. This session summarised what we went through during the entire five-day programme—mindfully putting ourselves in the shoes of people from disadvantaged backgrounds, and coming to understand more intricately and sensitively, the ways in which our living environment and habits shape health.



←
Prata making session

NUS Medicine Clinches Grand Gold in the CASE 2021 Circle of Excellence Awards

The 2020 edition *Going Viral: An Academic Year in the Time of COVID-19* is an annual publication which provides a snapshot of the School's work in education, as well as research and innovation efforts amidst the pandemic.



NUS Medicine was one of 39 Grand Gold recipients chosen worldwide, beating many organisations and universities to clinch the Council for Advancement and Support of Education (CASE) Circle of Excellence Awards under the “Publications”, “Institutional Relations Publications” and “Presidents Reports & Annual Reports” categories.

Each year, the CASE Circle of Excellence Awards recognises

the efforts of talented staff members from hundreds of institutions who advance their institutions through inspiring and creative ideas. Winners are selected based on several criteria: overall quality, innovation, use of resources and the impact on the institution or its external and internal communities, such as alumni, parents, students, faculty and staff. In 2021, CASE received almost 3,000 entries from 27 countries. Those entries came from 530 institutions across 100 categories.



Going Viral: An Academic Year in the Time of COVID-19 bagged the top Grand Gold Award.

The School's winning entry *Going Viral: An Academic Year in the Time of COVID-19* provides an account of the year in which a novel coronavirus upended life and business as we knew it. Classroom lectures and tutorials went virtual, as previously bustling campus facilities emptied and fell silent when Singapore went into a seven-week long circuit breaker to flatten the trajectory of the pandemic.

NUS Medicine had to review and revalidate the strategic game plan. The School revised and reconstituted its approach to medical education and research, reorientated and then pivoted to a different pace and rhythm of work. Emerging from the enforced countrywide curfew, it was apparent that technology had enabled much continuity of the School's work, with staff working relatively easily from home. This yearbook tells of how the School weathered the storm, and is a testimony to the grit, resilience and creative resourcefulness of the staff, students and alumni of the NUS medical school.

The judges commented on the entry, “While this report is dense, the information is presented in an organised fashion that highlights main points and makes the content digestible. The cohesive layout also facilitates this strong presentation of the content. The overall design is creative, with excellent use of colour and creative implementation of strong photography.”



Scan to read “Going Viral” here:

First in Singapore: WSQ Professional Biorisk Management Training Course at NUS Medicine

BY DR TESSY JOSEPH, ASSISTANT DIRECTOR, BSL-3 CORE FACILITY, NUS MEDICINE

For the past two decades, our world has been hit by numerous infectious diseases, such as SARS in 2003, followed by Swine Flu, MERS, Zika, Ebola, and now, COVID-19. As today's world is facing a myriad of emerging pathogens, the launch of the "Professional Biorisk Management Training" course by the NUS Medicine Biosafety Level 3 (BSL-3) core facility on 4 January 2021 could not be more timely. This inaugural Workforce Skills Qualifications (WSQ) biorisk management course lays the foundation for aligning the best biorisk practices in Singapore and aims to prepare biorisk professionals adequately in tackling future pandemics and the emergence of dangerous pathogens.

In the opening address delivered at the launch by Dr Su Yun Se Thoe, Deputy Director of Biosafety branch, Ministry of Health, she highlighted that this course will prepare Singapore's workforce with the appropriate biorisk management knowledge, skills and capabilities to better respond to future infectious disease outbreaks and pandemics in a safer and more secure manner.

The comprehensive modules covered in this course provide laboratory personnel with a foundation in biorisk management. The knowledge

and skills acquired from these modules enable participants to develop and implement a comprehensive biosafety and biosecurity management programme in biomedical laboratories of various industries such as education, healthcare, pharmaceutical, biomedical sciences and technology. It is highly imperative that laboratory personnel are trained in this area as they play a critical role in reducing or eliminating the risk of potential exposure to biological hazards and also in preventing the loss, theft or misuse of biological agents, materials and sensitive information.

This course saw its first batch of 19 participants successfully completing four core and two elective modules. Associate Professor Justin Chu, Director of the NUS Medicine BSL-3 Core Facility, delivered the opening address at the certificate award ceremony which took place on 31 March 2021. In his speech, he emphasised the importance and usefulness of this course and also commended the dedication of the BSL-3 Core Facility team who organised this course: "It is very timely we have started this training to enhance biosafety and biosecurity awareness, training more professionals in the field to support the national need for safely managing laboratories in Singapore, as well as protecting the personnel and the environment."



↑
Prof Chong Yap Seng, Dean, Yong Loo Lin School of Medicine, awarding the certificate to a participant (Ms Wong Wai Kwan, Deputy Director of National Parks Board, Animal & Veterinary Service, Singapore) who completed the Professional Biorisk Management Training course.

Many participants found the course highly relevant as it covered a wide range of biorisk management topics which can be applied to their workplace settings. Impressed with the way the course was conducted, one participant mentioned: "Scenario-based group discussions, practical sessions and the learning visit to the mechanical plant room of the BSL-3 core facility helped us to better understand the various points covered." There was also a call from the first cohort—encouraging biosafety coordinators, BSL-3 laboratory users and even top management to attend the course.



About Professional Biorisk Management Training

This course was developed under the WSQ framework, funded and quality-assured by SkillsFuture Singapore. It is recognised by the Ministry of Health as a qualification for the Biosafety Coordinator role in Singapore. Curriculum was developed and classes were conducted by in-house trainers including Assistant Director, Dr Tessa Joseph and Senior Manager, Ms Sindhu Ravindran who are both from the BSL-3 Facility at NUS Medicine. The mode of training is interactive with hands-on training. Biosafety professionals, laboratory managers, researchers or anyone keen to learn more biorisk management are all welcome to enrol.

Medical Education, Technology and Enterprise (METE)

BY ASSOCIATE PROFESSOR ALFRED KOW WEI CHIEH, ASSISTANT DEAN (EDUCATION), CHAIRPERSON, MEDICAL EDUCATION TECHNOLOGY ENTERPRISE (METE) COMMITTEE, NUS MEDICINE

Formed in 2019, the Medical Education Technology Enterprise (METE) Committee anchors NUS Medicine's strategic goal of promoting innovation in technology for teaching and learning in medical education.



METE aims to enhance the adoption of digital transformation in medical education, and serves to:



Regulate and encourage the adoption of technology-related teaching pedagogy



Review proposals for technology-related educational pedagogy



Link with the Undergraduate Curriculum Committee (UGCC) at NUS Medicine to recommend suitability for curriculum implementation



Review funding support for innovative technology-enabled pedagogy



Collaborate with industry partners to co-develop innovative teaching pedagogies



Explore potential enterprising opportunities for unique pedagogical tools created in NUS Medicine

The members of the METE committee comprise faculty members from the clinical departments, medical science cluster, nursing, enterprise office, legal office and administrative team from the Deanery.

Regulate technology-related teaching pedagogy and encourage technology adoption in medical education

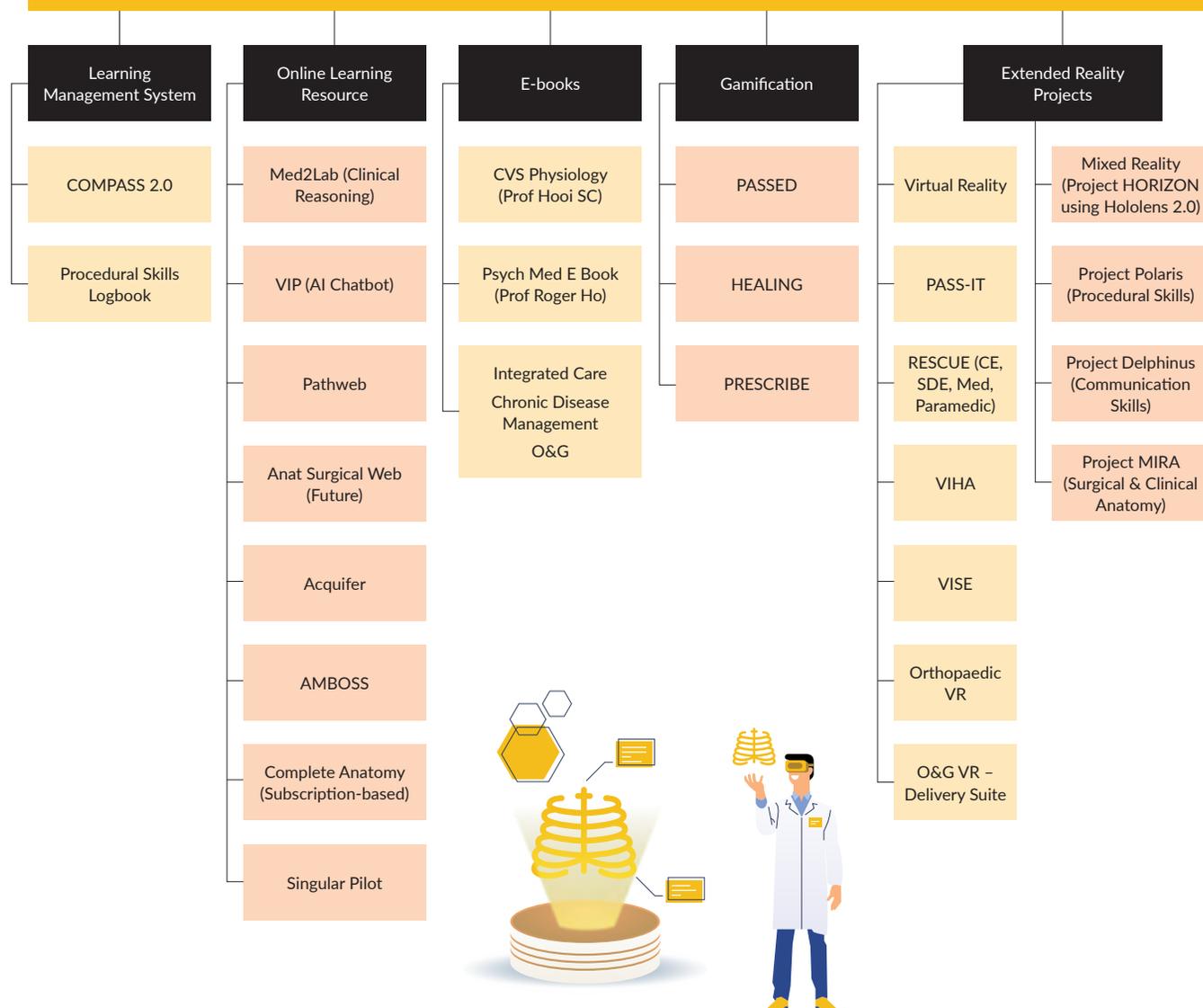
METE is the entry point for technology-enabled tools

in the market to be reviewed and assessed for suitability for implementation in our medical school curriculum. For example, METE reviewed the recommendations for AMBOSS, Acquirer, Body Interact and other software for implementation at the school. The usage and outcomes of the online tools are also carried out periodically to evaluate their suitability in the curriculum.

In order to encourage the adoption of digital transformation at the school,

we have identified various technologies which may be helpful in enhancing medical training. These are summarised in the chart below. Faculty members are encouraged—through various platforms—to think, explore, play, create and innovate using these technologies in medical education. By sharing success stories and showcasing projects at events such as NUHS Educator’s Day, we hope to raise awareness of the importance of digital adoption in medical education.

Technology-enabled Learning at NUS Medicine



Body to review proposals for technology-related educational pedagogy

METE is able to review the interesting proposals submitted by faculty members to provide appropriate suggestions and support for the projects. Through METE's effort, we have been able to provide invaluable input for applicants to enhance their projects, and continue monitoring the progress of the projects. One example is the PATient Safety aS Inter-Professional Training (PASS-IT 2) project. With the successful implementation of the PASS-IT programme, the PASS-IT team has received approval to develop further modules using virtual reality (VR) technology in teaching the niche topic of patient safety in surgery. PASS-IT 2 is currently at the initiation phase and METE is guiding the progress and implementation of the project along the way.

Linking with UGCC at NUS Medicine to recommend suitability for curriculum implementation

An appropriate review process has been put in place for identifying suitable online tools. We will conduct a trial period with free subscriptions from the software company in order to gather valuable feedback from the faculty members. Following that, suitable programs will be recommended for discussion at the UGCC. Where relevant, UGCC will explore with the stakeholders, including the educators at clinical departments and the medical science cluster, to explore the placement of these tools, either as self-directed learning or mandatory guided teaching tools. The bi-directional flow of information and



recommendations is essential to ensure robust evaluation of innovative teaching pedagogies before they are implemented into our curriculum. Often, a short pilot study is conducted to gather feedback before formal implementation.

Review funding support for innovative technology-enabled pedagogy

METE is able to provide some funding support for faculty members to develop innovative teaching pedagogies at the medical school. We have provided financial support for the Virtual Integrated Patient (VIP) program to facilitate its content development and scale-up to the implementation phase. In addition, we funded the development of NUS-Med2Lab project, which is led by Dr Chen Zhi Xiong and Dr Soh Jian Yi. The NUS-Med2Lab was developed with the purpose of cultivating a medical learning approach

and curriculum for critical reasoning through an online cloud- and case-based platform. Their teaching model combines coursework and technology to address the reasoning training needed for doctors of the future. This universally applicable model teaches critical reasoning by using a simulated virtual patient model. Students learnt through feedback, tailored to their own decision and reasoning patterns.

Working closely with developers based in San Francisco, the NUS-Med2Lab team has successfully created a few modules to teach clinical reasoning at the school. More modules are currently being developed and continuous funding support has been secured through the regular review process at METE.

Funding for innovative projects does not only come





solely from the medical school. METE has faculty members with vast experience in grant applications for technology-enabled educational tools. When information regarding suitable grant calls are made available, METE will strive to share these notices and information with the teaching communities. Interested faculty members can seek guidance to apply for these funds and appropriate advice is provided to shape and enhance the proposals before submission.

Collaborate with industry partners to co-develop innovative teaching pedagogies

Using METE as the base, many discussions have taken place to explore partnerships with industry partners in this field. Technology-enhanced innovative teaching tools are widely available in the market. Many of these companies have explored partnering NUS Medicine to



An NUS Medicine student learning in a virtual environment with the use of VR headsets and handheld controllers.

create innovative tools in medical education. One of our biggest partnerships currently is with Microsoft Corporation to develop medical training tools using the HoloLens 2.0 device, based on the Mixed Reality technology. Project Polaris, one of our first explorations done in close partnership with Microsoft, will explore using HoloLens 2.0 platform to develop procedural skills training.

Explore potential enterprising opportunities for unique pedagogical tools created in NUS Medicine

With the appropriate personnel in the committee, we are able to harness the expertise within the school to direct enterprising opportunities at the medical school. One such example is the VIP project. The VIP platform was developed to provide a limitless array of virtual patients. Medical students, early career medical graduates and general practitioners have limited access to patients due to patients' reluctance to be used as subjects, rarity of certain diseases, etc. Such limitations compromise the development of clinical reasoning skills and diagnostic skills. VIP can randomly generate clinically realistic patients to supplement the gap in medical training and allow true conversation engagement with the virtual patient via a chatbot. VIP also plans to launch speech recognition and voice output on the platform in the future. Created in-house by Prof Edmund Lee, Dr Judy Sng and their team, this project has achieved significant success, and the team is in the process of commercialising this tool for wider use in the medical education community.

Conclusion

At METE, we hope to encourage the faculty members in the school to think about technology as a potential solution to fill curriculum gaps where relevant. In medical training, nothing will be able to replace the sacred relationship between the doctor and the patient, and the fundamentals of medical training will continue to be on patient and real clinical experience. However, technology can enhance the training through standardisation of experience, reducing opportunistic encounters, increase interactivity and making medical training fun. In addition, we can better prepare our students through simulation of these experiences, and also raise awareness of patient safety, before they enter the clinical training environment. The wave of the 4th Industrial Revolution is already here. We must actively embrace the technology and digital transformation with open arms in medical education.

Educators, students and administrators are encouraged to submit their project proposal for funding support from the METE Committee—whereupon the value proposition of the project enriches the learning experience of students. The METE secretariat has digitalised the application and submission of proposal to make the process seamless, convenient and easy.

Scan to see more information about METE here:





Goh Keng Swee Foundation Gifts S\$1.2m in Support of Medical Education

The Goh Keng Swee Foundation, established by Dr Phua Swee Liang in 2008 to perpetuate her late husband's values, announced on 14 May 2021 a gift of S\$1.2 million to the NUS Yong Loo Lin School of Medicine (NUS Medicine) in support of financially disadvantaged medical students.

The gift was announced on the 11th death anniversary of Dr Goh, who passed away on 14 May 2010 at the age of 91 after years of ill health, during which he was nursed by Dr Phua. The late Dr Goh served alongside Singapore's

founding Prime Minister Lee Kuan Yew, holding Cabinet appointments as Deputy Prime Minister, as well as helping the finance and defence portfolios at key stages of Singapore's development.



1 in 6

NUS medical undergraduates needs financial assistance



Close to 70

medical students benefitted from Goh Keng Swee Foundation's donation to the NUS Medical Society - Christine Chong Hui Xian Bursary

He is widely regarded for his role in the development of Singapore into a prosperous nation. As early as 1981, Dr Goh set up the Government of Singapore Investment Corporation (GIC) with the foresight to protect Singapore's reserves from unforeseen economic crisis. In the year before his retirement from political office, he sowed the seeds of biotechnology in Singapore, with his involvement in the introduction of Nobel laureate Dr Sydney Brenner to Singapore, and the establishment of the Institute for Cell and Molecular Biology (IMCB).

"I am very pleased that Dr Goh's life and memory will be honoured by this gift to NUS Medicine. In his dealings with people, Dr Goh was genuine and made no distinction between race, religion, gender, wealth or power. His compassion and thoughtfulness towards people has always moved me and it is my hope that recipients of this bursary will embody the same attitude towards their patients and those around them," said Dr Phua.

The Foundation was set up by Dr Phua two years before the passing of Dr Goh, who was also Minister for Education as well as Chairman of the Monetary Authority of Singapore (MAS), and headed various government-led companies. As Singapore's first Minister for Finance in 1959, he introduced a massive industrialisation programme and transformed the swampy Jurong into Singapore's first industrial estate. Dr Goh also

initiated the establishment of the Economic Development Board (EDB) in August 1961.

The Foundation has been a longstanding donor to the NUS Medical Society - Christine Chong Hui Xian Bursary, set up in 2011. The bursary commemorates the late Christine Chong, from the Class of 2012, who succumbed to cancer during the course of her studies. In memory of her passing, the 62nd NUS Medical Society formed a committee to raise funds for an endowed bursary. They approached the Foundation and Dr Phua was so impressed by the knowledge that the students themselves contributed funds to initiate the bursary, that she instantly made a sizeable contribution. Since then, the Goh Keng Swee Foundation has frequently made donations to add to the fund. Since its inception, the bursary has helped close to 70 medical students to significantly alleviate the financial burden of their medical education.

NUS President Professor Tan Eng Chye said, "We are deeply appreciative of this generous gift from Dr Phua. It will go a long way towards nurturing the next generation of medical leaders, helping train the compassionate and competent doctors that Singapore needs, as well as advancing the science and practice of medicine in Singapore."

Professor Chong Yap Seng, Dean of NUS Medicine, expressed the School's gratitude for the Foundation's gift, "We are deeply honoured and grateful for this gift from Dr Phua and the Foundation. One in six of our medical undergraduates needs financial assistance and this gift from the Foundation will be invaluable in alleviating their financial worries, allowing them to fully experience the benefits of a comprehensive medical education and contribute to the greater community as students."

"Dr Goh's life and memory will be honoured by this gift to NUS Medicine. In his dealings with people, Dr Goh was genuine and made no distinction between race, religion, gender, wealth or power. His compassion and thoughtfulness towards people has always moved me and it is my hope that recipients of this bursary will embody the same attitude towards their patients and those around them."

Dr Phua Swee Liang

Ah Leng's Canteen



Ah Leng, the legendary owner and operator of the eponymous canteen at Sepoy Lines so beloved by earlier generations of medical students, passed away on 31 May 2021. We reproduce the article below in memory of the man whose beverages and simple canteen menu fed generations of medical students.



Counsellor, banker, provider of food and drink—Wong Ngiap Leng operated Ah Leng’s canteen on the University’s former campus. He is remembered fondly by several generations of students for the kindness he showed to many of them who could not pay for their meals. Mr Wong reminisced about the time when he operated the canteen for seven days a week, from 1947 to 1983.

The funny part about Ah Leng’s Canteen is that it wasn’t a name picked by my father, who started the canteen in the 1920s, or me. At that time, the hospital was called Sepoy Lines by the British and my father just ran the canteen... and it never had a name. Ah Leng’s Canteen was just the way all the medical students of that time referred to it and I guess it just stuck. And, in a way, it is apt since I was born there!

I took over the canteen in 1947 when my father went back to China—he had to shut it during the war (World War II). I was 19 years old and had just got married, so my wife helped me at the canteen.

Many of our customers were students who returned to medical school after the war. At the time, there was no Singapore or Malaysia, so there was no difference. It was just hostelites at King Edward VII College of Medicine and non-hostelites. And because we lived on the premises, we opened the canteen at 6am and closed only around 7pm. At that time, we served toast with half-boiled eggs, coffee, tea, Milo, Horlicks, curry puffs and ham and cheese sandwiches. One piece of toast at the time cost 10 cents.

Later, we started serving kway teow, chicken rice, bee hoon and eventually even hamburgers for lunch and dinner. I remember Dr Mahathir (former Malaysian Prime Minister Tun Dr Mahathir Mohamad, Class of 1947) liked my bee hoon soup.

After I closed my canteen at 7pm, I ran a small stall on the roof of KE Hall, serving snacks and hot drinks to the hostelites until midnight. Then I would go home. It was like that seven days a week.

I don’t know why the students liked my canteen. It was a cosy corner where they all sat and chatted. But I can still recall the smell of the chemicals wafting into the canteen from the anatomy department (now a carpark near Harrower Hall). Or was it the smell of the dead bodies? I was not sure.

Some of the students were hiding from lecturers, others were waiting for boyfriends or girlfriends. I don’t want to say who they are but most of them are successful doctors now. And because we were near the sports field, students would pop in after playing football, cricket or hockey. There were a few fights after the games, but not at my canteen.

Ah Leng and his wife at their canteen for the last time before it was shut down on 2 June 1983.



My wife and I lived at the back of the canteen with our four children until we bought our flat at Tiong Poh Road in 1966. We could walk across the road from the canteen. There was no expressway (AYE) then and we walked through the field using a torch because it was so dark.

It is true some of the students borrowed money from me to pay their fees or for food. Some of them also gambled. I kept records of what people owed me in the tiga lima buku (555 books). Most of them paid me back once they started working. Some forgot, but it is okay. The names are still in some of the 555 books which are in a locked box. I won’t let anyone see them.

I collect all the newspaper articles about the canteen. I also received a copy of a special book (the Centenary of Tertiary Education by the Medical Alumni) where the doctors printed my name on the cover. Dr Ngiam Tong Lan also wrote a poem about me. In 2005, Professor Tan Ser Kiat asked me to make tea at the opening of Duke-NUS Graduate Medical School at the Singapore General Hospital (SGH) grounds. I was so happy to go back to SGH to make the same tea I made for all of them when they were students.

I am 86 years old now. I still remember everything; I remember everyone. They are always in my head and in my heart.

This story first appeared in the MOHH book “Caring for our people” and was reproduced in the February 2020 issue of the School’s newsletter, *MediCine*, with the kind permission of the publisher.



Living Better, Longer: How Research Is Giving New Life to Ageing

BY DR KHOR ING WEI

When I was younger, I thought the term “ageing gracefully” had a nice ring to it. I rather liked the idea of someone describing the 70-year-old me this way as I sipped chamomile tea and knitted a scarf.

Fast forward to the 2020s and aspiring just to age gracefully smacks of low ambition in the face of research that aims to slow or even reverse the ageing process.

Some of this exciting work, especially resonant in Singapore with its rapidly ageing population, is taking place in the NUS Medicine Healthy Longevity Translational Research Programme. The programme brings together scientists from a broad range of disciplines to investigate the many aspects of ageing. The researchers aim to achieve a more comprehensive understanding of how the

body ages and, ultimately, find ways to improve the health and vitality of people as they grow older.

The work could not come at a better time, what with the rapid ageing of the Singaporean population. In 2019, 12.4% of Singaporeans were older than 65 years. By 2050, this proportion is projected to almost triple to 33%.^{1,2}



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of Singaporeans
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in 2019

33%
of Singaporeans
would be older
than 65 years old
by 2050

Just after age 30, our bodies begin to deteriorate and our functioning declines in a systemic ageing process called senescence. However, the most important part of ageing is not the actual age, but rather maintaining a high quality of life for as long as possible.

The Healthy Longevity programme includes 39 members of faculty who specialise in one of four focus areas: systemic ageing, brain ageing, vascular ageing, and female reproductive ageing. The programme lead, Professor Brian Kennedy, is a professor in the departments of Biochemistry and Physiology at NUS Medicine, and the former President and CEO of the Buck Institute for Research on Aging in Novato, California. The programme is one of nine Translational Research Programmes that were established at NUS Medicine in 2020; bringing together basic



*About the
Healthy
Longevity
programme*

39

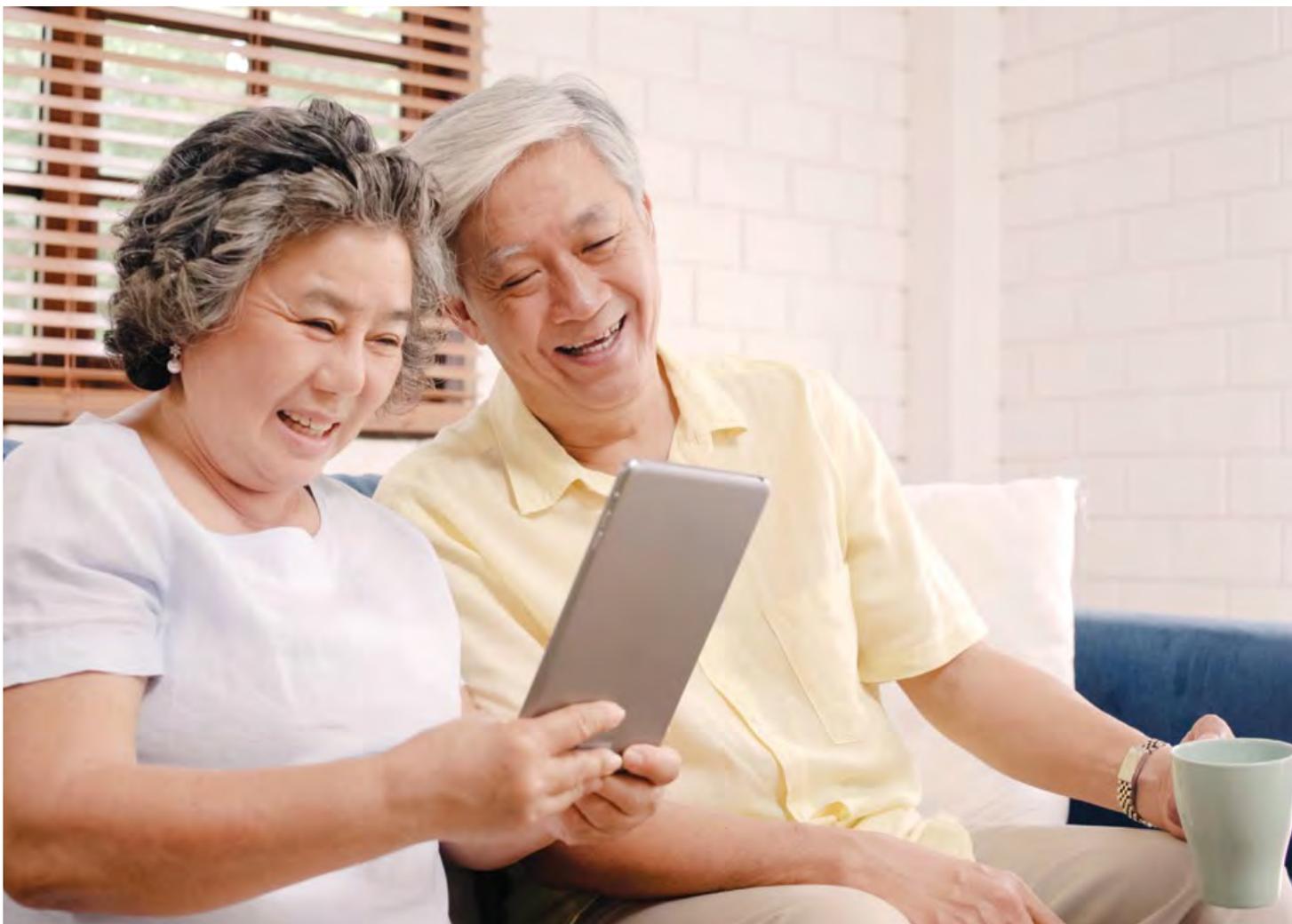
faculty members specialising in one of 4 focus areas: **systemic ageing, brain ageing, vascular ageing, and female reproductive ageing**

and clinical scientists from different disciplines to address an important disease need or research question.

The lifelong process of growing old

In the area of systemic ageing, researchers are working to understand the mechanisms governing how the body ages as a whole and find interventions that slow or reverse the process. Prof Kennedy will be working with Professor Andrea Maier, a new faculty member in the Department of Medicine who specialises in human ageing studies. One study involves measuring 10 biomarkers in

the Singaporean population aged 40 years and older. These biomarkers include classical indicators like pulse rate velocity, DEXA scans, VO₂max, and grip strength, new AI-based markers including the epigenetic clock, integrated complete blood count data and metabolomics, as well as an assessment of age based on 3D facial reconstruction analysis. The idea is to identify people earlier (say, around 40 years old) who have markers that indicate a propensity for unhealthy ageing. These people can then be targeted for interventions to prolong their years of healthy life.



Another exciting study in the field is being headed by Professor Koh Woon Puay and involves deep characterisation of the ageing process in individuals during their 60s and 70s. This is an important period in a person's life, during which some people remain highly functional and disease-free while others experience significant functional decline and multiple morbidities. Understanding what keeps people healthy in this age range will help to inform the development of strategies for ageing populations.

"The healthcare challenge of an ageing population is one of the biggest issues facing Singapore in this century. By understanding the ageing process, the Healthy Longevity Translational Research Programme seeks to develop strategies to keep people healthy, happy and active as they age," said Prof Kennedy.

In Singapore, brain ageing conditions such as dementia are increasing in prevalence with the rapid ageing of the population. Associate Professor Christopher Chen, a researcher in the Healthy Longevity Translational Research Programme, is leading the SINGapore GERiatric intervention study to reduce physical frailty and cognitive decline (SINGER).² This study showed that interventions that prevented the onset of dementia in Finland (in a Finnish study called FINGER) are likely to be effective in the Singaporean population. These interventions included diet, exercise, cognitive training and monitoring of vascular risk factors such as blood pressure. In addition, the SINGER

"The healthcare challenge of an ageing population is one of the biggest issues facing Singapore in this century. By understanding the ageing process, the Healthy Longevity Translational Research Programme seeks to develop strategies to keep people healthy, happy and active as they age."

Prof Brian Kennedy, Lead, Healthy Longevity Programme

researchers made modifications to the FINGER interventions that may be even more effective in the local population. The next step is to conduct a clinical study to compare outcomes between a group that receives the interventions and another group that does not.

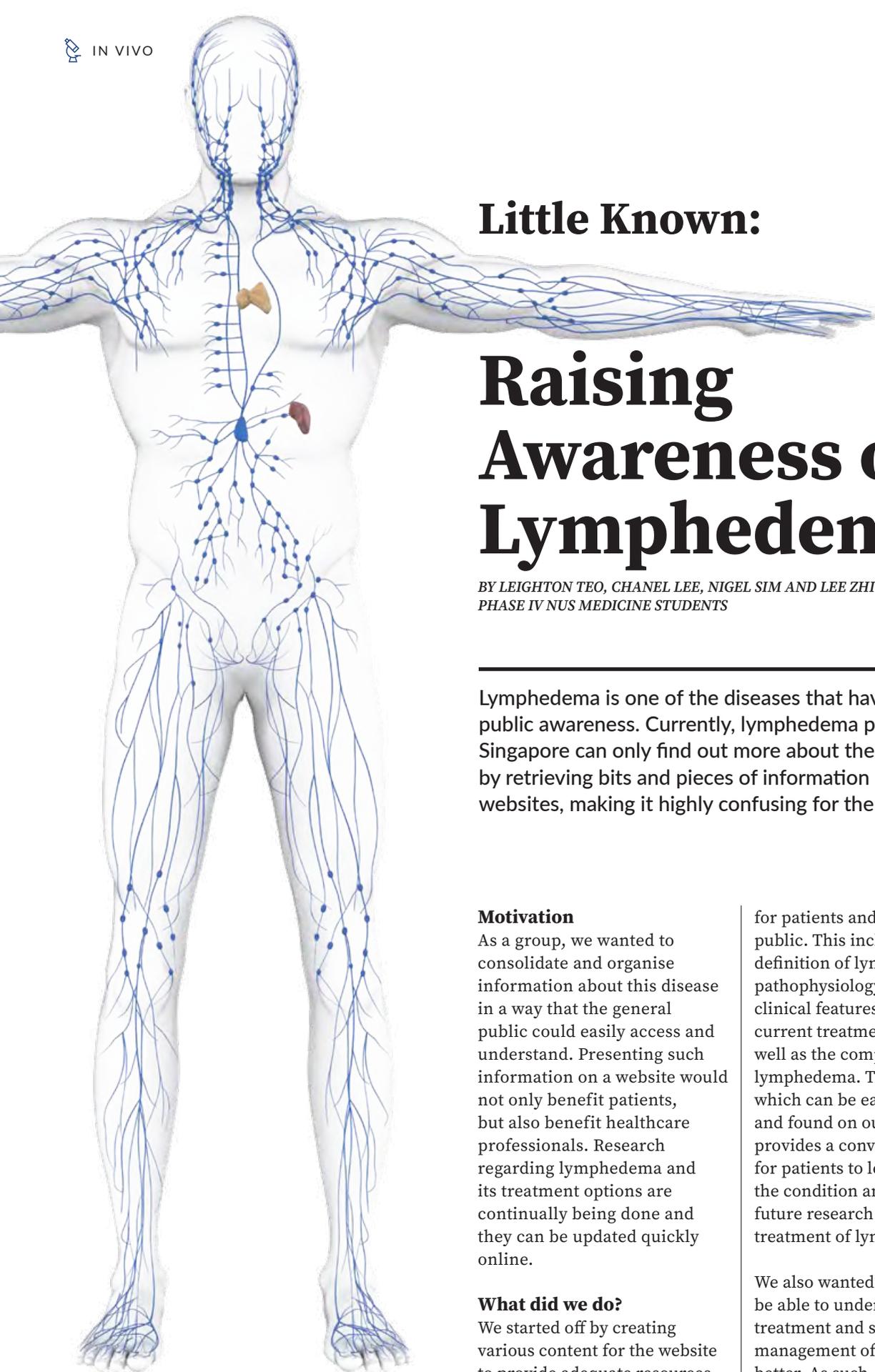
Ageing in the cells that make up our blood vessels also has wide-ranging impacts, potentially causing vascular diseases such as heart disease and stroke. Biomarkers such as cholesterol and triglyceride concentrations are predictors of vascular ageing and the risk of morbidity and mortality. Associate Professor Raymond Seet, Deputy Director of the programme, is overseeing the development of research in this area, with ongoing clinical cohorts and molecular studies.

As more women around the world are deciding to have children in their 30s and 40s, ageing and fertility has become an important research focus internationally. Professor Rong Li from the Mechanobiology Institute at NUS and Dr Huang Zhong Wei from the Healthy Longevity Translational Research Programme, are developing candidate therapeutics for female reproductive ageing, which they plan to test in clinical trials. A new initiative, the Asia Centre for Reproductive Longevity

and Equality, was recently set up to study ways to extend the period of reproductive fitness for women. This is an exciting new direction of research, as the relationship between reproductive ageing and systemic ageing remains poorly understood. This institute, which involves researchers from the Healthy Longevity programme, was funded by a donation from Ms Nicole Shanahan, President of the Bia-Echo Foundation. The foundation supports research in healthy longevity and equality, among other causes.

Just after age 30, our bodies begin to deteriorate and our functioning declines in a systemic ageing process called senescence. However, the most important part of ageing is not the actual age, but rather maintaining a high quality of life for as long as possible. Instead of our bodies slowing down as we age, the researchers in the Healthy Longevity Translational Research programme are working to slow down the ageing of our bodies which is good news for all of us. Perhaps I can put my knitting needles away for a bit longer.

1. Chen C, Xu X, Chew E, Henry CJ, Koo EH. Singapore intervention study to prevent cognitive impairment and disability (singer) initiative. *Alzheimers Dement*. 2017;13(7).
2. United Nations, Department of Economic and Social Affairs, Population Division. New York: United Nations: World Population Ageing; 2019.



Little Known:

Raising Awareness of Lymphedema

BY LEIGHTON TEO, CHANEL LEE, NIGEL SIM AND LEE ZHI YAN,
PHASE IV NUS MEDICINE STUDENTS

Lymphedema is one of the diseases that have low public awareness. Currently, lymphedema patients in Singapore can only find out more about their conditions by retrieving bits and pieces of information from various websites, making it highly confusing for the patients.

Motivation

As a group, we wanted to consolidate and organise information about this disease in a way that the general public could easily access and understand. Presenting such information on a website would not only benefit patients, but also benefit healthcare professionals. Research regarding lymphedema and its treatment options are continually being done and they can be updated quickly online.

What did we do?

We started off by creating various content for the website to provide adequate resources

for patients and the general public. This included the definition of lymphedema, pathophysiology, causes, clinical features, staging, current treatment options as well as the complications of lymphedema. This information, which can be easily accessed and found on our website, provides a convenient platform for patients to learn more about the condition and encourages future research into the treatment of lymphedema.

We also wanted patients to be able to understand the treatment and subsequent management of the disease better. As such, we created

videos so that patients would be able to refer to them in the comfort of their homes in the event that they cannot remember how to put on the various compression garments. We hope that through educational resources found on the website as well as videos provided, patients would be able to better care for themselves and prevent further deterioration.

We also helped in the formulation and brainstorming of the logo for Lymphedema Society Singapore.

Learning experiences

As medical students, learning should go above and beyond that of our classroom curriculum. This venture has provided an opportunity for us to learn more about lymphedema as well as understand the possible treatment options available.

As we embarked on this project during the circuit breaker period, we faced many challenges while attempting to complete it.

Firstly, this project is demanding as it requires us to learn and master new skills in a limited amount of time. Unlike other projects, we are required to know skill sets which were beyond our curriculum: these were video editing, video-taking and website creation. All of us had no prior experience in these areas.

Secondly, as face-to-face meetings were not possible, meetings via Zoom were conducted. These virtual meetings were not as productive as physical meetings and it was not easy to find suitable time slots for all of us to meet.



(From top left clockwise)
Medical students Leighton Teo, Nigel Sim, Chanel Lee, and Lee Zhi Yan discussing the types of content that should go on the new Lymphedema Society of Singapore website over a Zoom meeting during the circuit breaker in 2020.

As these transitions were very new, we had to adapt ourselves to the limitations of these meetings. Zoom did not allow multiple people to speak so we decided that one person should talk at a time to ensure effective communication among the team members. Zoom also had a 30-minute time limit for each meeting and as such, we kept creating new Zoom meeting sessions after every 30 minutes.

Thirdly, we had to learn how to work as a team effectively and efficiently. Initially, we edited a single video together which took us more time than expected as there was no virtual platform to edit videos concurrently. After the first video was done, we decided to delegate the various roles to each member such as voice-overs, video splicing, background music sourcing, music splicing, which helped us to cut down on the amount of time spent on each video. Hence, we were able to meet the tight deadlines quickly, and also produce quality videos.

Even though this project took a lot of time and effort, we are very grateful for this opportunity as we were able to learn more about lymphedema as well as improve our skills and work effectively as a team.



Associate Professor Tan Bien Keem (top) from Singapore General Hospital and Associate Professor Veronique Angeli (bottom) from the Department of Immunology at NUS Medicine mentored the four students throughout the duration of this project.



Scan to view website here:

All the Buzz and Bites of Malaria

In April 2021, the Department of Microbiology and Immunology at NUS Medicine was abuzz with anticipation and activity, as researchers, staff and students came together to mark World Malaria Day.

The idea of having a department-organised initiative to highlight the complex issues surrounding malaria was first put forward by Dr Ch'ng Junhong, a lecturer from the department. He explained, "Malaria is an infectious disease that is still endemic in many countries today, and we believe that commemorating World Malaria Day offers us an opportunity to look beyond the biology of the disease, which is typically what is emphasised in the School, to the interdisciplinary issues that underpin real world progress."

As part of the initiative, Dr Rajesh Chandramohanadas,

a senior lecturer from the department, led a team in organising an on-site event which comprised a series of short, live seminars by researchers from NUS Medicine, pre-recorded talks by international guest speakers, games and activities, as well as a showcase of malaria-related exhibits and photographs.

Discussing the history of malaria in Singapore, the situation in countries plagued by the disease, elimination efforts and vaccine development across the world, the outreach shed light on current research surrounding malaria, and why the disease is still relevant to Singapore.



Did you know?
World Malaria Day is on 25 April

"Malaria is an infectious disease that is still endemic in many countries today, and we believe that commemorating World Malaria Day offers us an opportunity to look beyond the biology of the disease, which is typically what is emphasised in the School, to the interdisciplinary issues that underpin real world progress."

Dr Ch'ng Junhong





Dr Rajesh Chandramohanadas observing malaria-infected blood cells under a microscope.

In circle: Microscopic view of malaria-infected blood cells (visible as blue dots) among human red blood cells (stained light purple).



“Although Singapore was declared malaria-free by the World Health Organization in 1982, the nation remains surrounded by countries vulnerable to the disease. We play an important role in the global fight against the debilitating disease, and it is my hope that our outreach can help explain how we are contributing towards that.”

Dr Rajesh Chandramohanadas

“Although Singapore was declared malaria-free by the World Health Organization in 1982, the nation remains surrounded by countries vulnerable to the disease. We play an important role in the global fight against the debilitating disease, and it is my hope that our outreach can help explain how we are contributing towards that,” shared Dr Rajesh Chandramohanadas.

To inspire conversations on malaria, the department also carried out a virtual walkathon to raise awareness of malaria relief efforts across the globe, and put together an extensive series of malaria-related content on social media. Led by Dr Ch’ng, the department’s social media team introduced the biology and on-the-ground

context of the disease through bite-sized information and interesting trivia on malaria and the global research work.

Associate Professor Kevin Tan, who heads the department, added, “It is important to recognise that the war against malaria is not yet over. We hope that through our team’s outreach efforts, we have helped the larger audience see the need for continued investment and commitment for malaria prevention. We believe the initiative has also offered our students insight on what education entails—that beyond achieving good grades, there is very significant and real impact on what is taking place globally, in terms of the political, geographical and demographical aspects of infectious diseases.”



Find out more here:



<https://www.straitstimes.com/singapore/health/singapore-a-hub-in-region-for-malaria-research>.



<https://www.straitstimes.com/singapore/can-malaria-outbreaks-bite-spore-again>.



<https://www.againstmalaria.com/>.

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COVID-19 Vaccination Passes or Passports: Special Rules in Special Times?

BY DR VOO TECK CHUAN, ASSISTANT PROFESSOR, CENTRE FOR BIOMEDICAL ETHICS, NUS MEDICINE

Problematic ‘privileges’

As countries roll out their COVID-19 vaccination programmes, a pertinent question is whether it would be ethically acceptable to have “special rules” for vaccinated individuals. What this means is that vaccinated individuals would be granted certain “privileges” that unvaccinated individuals would not have in the context of the pandemic.

Such privileges may include exemptions from public health measures, such as wearing a mask in public; being allowed to participate in social or mass gathering events like spectator

sports; or, travel internationally without the need to produce a negative COVID-19 viral test and/or undergo quarantine.

A policy of differentiated public health measures for vaccinated individuals is socially and ethically contentious. Even the term “privileges” may be regarded as problematic. It may imply that non-vaccinated individuals are an “underprivileged” class, and that something extraordinary is being granted, whereas the policy under consideration aims to lift or relax restrictions of fundamental freedoms or liberties.

How might such a policy be practiced? One way is to issue a vaccination record to the vaccinated individual which serves as proof of vaccination, and this is then used as a “pass” or “passport” for access to some activities. Proof of vaccination becomes a condition or requirement for exclusive entry into a place or the provision of service.

Differentiated public health measures: Yea or nay?

What might ethically support a policy of differentiated public health measures? Reasons include reducing burdens on individuals and restoring social and economic activities to benefit communities and businesses.

In a context of broad use of public health measures, vaccination certificates may represent a less restrictive policy option if it does not jeopardise public health goals. A necessary condition therefore is that there should be sufficient evidence that vaccination significantly reduces the risk of infection and transmission.

There is emerging evidence that some current authorised COVID-19 vaccines have this effect but scientific assessment is ongoing. Hence, where a substantial portion of a society is not vaccinated, public health authorities should exercise caution in removing measures even for vaccinated individuals, as this may contribute to the spread of SARS-CoV-2 and potentially severe cases and deaths.

Another reason for introducing differentiated measures for vaccinated individuals is to incentivise vaccine uptake. This may backfire. While the introduction of a vaccination pass may incentivise more people to receive a vaccine, it may also be regarded as coercive and may increase vaccine hesitancy. Vaccine hesitancy, defined here as a delay in acceptance or refusal of a vaccine despite its availability, is a complex issue. Factors vary for different societies and populations. It may persist because of concerns about the vaccine offered (which may be due to misinformation) or lack of trust in public health or governmental authorities because of current or historical injustices perpetuated by these authorities. Using the benefits of a vaccination pass to compel vaccination may increase refusal of vaccination because of concerns over privacy issues. Where vaccination passes are used, measures should be implemented to protect data security and privacy, in addition to ensuring the validity and authenticity of individual

What might ethically support a policy of differentiated public health measures? Reasons include reducing burdens on individuals and restoring social and economic activities to benefit communities and businesses.

vaccination status. Still, vaccination passes might increase vaccine hesitancy because of concerns over function creep (e.g., surveillance of individual health status, commercial use).

What ethical reasons might oppose differentiated measures? In a context of limited supply, public health authorities need to set priority groups for vaccination—those that are at high risk of severe outcomes if infected, or at high risk of infection and transmission—so as to achieve population level outcomes such as preventing death and an overwhelmed health system. Accepting that some groups should be prioritised depends on solidarity, whereby individuals who are not prioritised wait for the opportunity to be vaccinated for the good of all. It would be unfair and socially divisive if individuals in non-priority groups not only do not equally benefit from the protection of vaccination, but they are also denied the privileges of a vaccination pass. It may be argued therefore that vaccination passes should be applied only in a context where there is equal access to vaccines and the opportunity of obtaining a vaccination pass.

Vaccines and travel

Distribution of COVID-19 vaccines globally is currently highly inequitable. One reason that the World Health Organization (WHO) does not support proof of vaccination for international travel as a requirement for entry into or departure from a country is that it might result in the diversion of vaccine supplies from priority groups to the preferential vaccination of travellers.

Plausibly, vaccination passes may be ethically deployed for domestic purposes in countries that could provide vaccines for most if not all of their residents who want to and could be vaccinated. Israel is one such country. Vaccinated individuals were issued “green passes” which they could use to access places such as restaurants or gyms. Israel has since cancelled such a programme and would lift almost all COVID-19 public health measures in the country because it has achieved a high population-wide vaccination coverage. This is a matter of risk tolerance on the part of policymakers—that is, their acceptance that the benefits of reopening society outweigh the residual risk of community transmission.

Governments should commit to the lifting of restrictive and burdensome COVID-19 measures for all in their society so as to protect freedom of movement and other fundamental liberties, and promote equal opportunity to participate in and benefit from civil, social and economic life. Special rules for vaccinated individuals, if used, should therefore be like special discounts: temporary and limited in their application.



About the Author:

Dr Voo Teck Chuan is a member of the WHO Ethics and COVID-19 International Working Group. Portions of this article are adapted from earlier drafts of the forthcoming WHO policy brief on “COVID-19 vaccination certificates or passports and lifting public health and social measures: Ethical considerations” for which the author is lead drafter.

Don't Slip Up on Sleep

BY STIJN MASSAR, SENIOR RESEARCH FELLOW AND PROFESSOR MICHAEL CHEE, PRINCIPAL INVESTIGATOR, THE CENTRE OF SLEEP AND COGNITION, NUS MEDICINE



The benefits of good sleep are well known. After a poor night of sleep, we feel groggy, moody, and we have trouble staying focused. There is enough evidence that people do not perform their best when they are not well-rested.

Yet, many of us find ourselves regularly going to bed later than we had intended.

Even if we have a busy day ahead, we may be tempted to stay up later than we know is good for us.

Bedtime procrastination, as this phenomenon is called, was first described by Dutch psychologist Dr Floor Kroese and refers to a pattern of choosing to go to bed later than intended despite being aware of negative consequences.

This behaviour was found in 53% persons in the original Dutch study in 2014. In the research work we conducted among Singaporean adolescents, university students, and working adults, 28% of 321 respondents indicated that they occasionally go to bed later than intended, while 55% reported frequently struggling with this.

People often find it hard to disengage from their activities and go to sleep. When we are catching up on our favourite drama shows, it may not seem so important to be fresh the next morning.

Just one more episode

In this era of digital media, it is hardly surprising that people feel tempted to stay up late. The internet provides an endless offering of entertainment, education, and everything in between.

Studies have shown that using e-devices close to bedtime can disrupt sleep and push back bedtime. Phones can have an alerting effect due to the content and light emitted. Often, we are just engrossed in the media, and we cannot resist the urge to watch just one more YouTube clip.

Our data shows that people who use their phones more heavily during the hours before bedtime, sleep later by 40 minutes on average, compared with a group of light phone users.

Furthermore, 65% of respondents indicated that scrolling their phone, or engaging with some types of electronic media, was one of the activities that kept them from going to bed on time.

Sweet revenge

Another factor that may influence our sleep habits is our work or school pressure. A Duke-NUS study found that Singaporean secondary school students spent on average 2.9 hours a day on homework during weekdays and 4.5 hours during weekends. Time spent on homework was directly related to shorter time spent in bed for sleeping. On weekdays, the primary precondition for going to sleep, was that homework was finished.

Browsing our phones might be the last thing that we do before sleeping, but often the time before that is packed with school and work assignments. In our data, after digital media, finishing school or work assignments was the second most often mentioned reason for bedtime procrastination.



Bedtime procrastination

28%

of Singaporeans surveyed indicate that they occasionally go to bed later than intended

55%

of Singaporeans surveyed report frequently struggling to go to bed on time

65%

of Singaporeans surveyed indicate that scrolling their phone or engagement with electronic media were among activities that kept them from going to bed on time

Moreover, high pressure and packed schedules could drive us to further push back our sleep, as we seek to regain some “me time”. This phenomenon has recently become known as “revenge bedtime procrastination”.

Popularised on Chinese social media, many people describe how they feel the strong need to reclaim time for themselves, freeing themselves from the constant demands of their jobs.

One respondent in our study described it, “...after the kids are in bed, and household chores are done, after that, I need some time to relax. Watching videos, reading online. That keeps me happy.”

What can we do about it?

While it is easy to recognise the issue, it is harder to prevent it. Here are some things that we can do to counter the urge to procrastinate our bedtime.

First, have a planned bedtime, and have a bedtime plan. Adolescents whose parents set bedtime sleep significantly longer than those whose parents do not. But equally important is to have a plan in mind on how to go about it. What time should you get ready for bed? When should I put down my phone? What are the obstacles to achieving my plan?

Be intentional about limiting screen time before bed. Start a movement among your friends not to message, except for emergencies, past 10pm.

Second, plan to get some physical exercise. Only 35% of Singaporeans exercise regularly and overall, 44% of physical activity comes from commuting which has been significantly reduced as a result of hybrid work.

Moderately intense aerobic exercise benefits sleep and often exposes one to natural light. Morning light exposure perks up the brain and keeps our circadian clock from drifting to seeking later bedtime.

Third, there needs to be a sea change in how we influence one another about after-hours work. The potential time savings and work-hour productivity gains from not having to battle through the daily commute should be gains. Both employees and managers should co-operate to complete planned tasks in a timely fashion. Homework can be cut if learning is paced in a manner that accommodates different learning rates to ensure thoughtful assimilation. This will leave time for all to collectively reflect on how to be more effective instead of merely ticking off checkboxes. Everyone should collectively review the hosting of serial virtual meetings where participants are mentally absent. Consideration should also be given for time and energy chipped away by childcare and home-based learning.

Lastly, we should be aware that, in the modern economy, our waking hours have become a commodity. Netflix CEO Reed Hastings once said that the company’s biggest competitor is sleep. Companies are competing for your engagement and will fight for every opportunity to do that. Whether through dwelling on whether to make that online purchase, e-games, video streaming, sports offerings or e-gossiping, the addictive nature of engaging in any or all of these activities is something few can resist. By cutting your sleep, you may become the victim of your own revenge.

This commentary was earlier published on channelnewsasia.com on 15 June and has been edited for *MediCine*.

Knocking on Wood – Superstitions, Taboos and Meaning- making in Medicine

BY DR NOREEN CHAN, HEAD AND SENIOR CONSULTANT, DIVISION OF PALLIATIVE CARE,
NATIONAL UNIVERSITY CANCER INSTITUTE, SINGAPORE

Years ago, when I was working in the Emergency Medicine Department (EMD), one of our colleagues returned from a trip to her hometown—Penang—with many types of “edible souvenirs”, including a type of Chinese flaky biscuit called “pong piah” from a famous shop near her neighbourhood. Everyone who tried it agreed it was indeed delicious. But after the shift turned out to be a crazy-busy one, everyone decided that “pong piah” would be banned from the EMD.



Can a type of baked goods really influence how many patients turn up at the hospital? That does not seem scientific at all. But it may surprise you to learn that doctors can be as superstitious as anyone else, and before going on call, it is quite common to avoid certain foods or actions. In 2007, Dr Erle Lim and colleagues wrote about this phenomenon in the *Annals of the Academy of Medicine Singapore*, called “Take a Bao if You Are Not Superstitious”¹.

In Western cultures, it would be more common to worry about Friday the 13th, but in Singapore it is the bao that has a bad reputation. Bao or steamed buns, are widely avoided because the word “bao” sounds like “to wrap”, a euphemism of having to perform last offices for a deceased patient. Meaning to say, if you ate bao, you might increase your chances of having more patients die during your shift.

This widely held belief was tested by Dr Tan Min-Han and his colleagues in a study published in 2008, aptly

called “The Tao of Bao”² which compared the effect of eating bao and its supposed results brought upon the night shift. I was actually working at Singapore General Hospital during the time the study was being conducted, and remember that I was typing up a consult when the study coordinator came into the Residents Room and handed a brown paper bag to the junior doctor who was beginning her on-call shift. She nervously peeped inside and heaved a sigh of relief—“yay, chocolate bar”.

So what was the result? Not surprisingly, there was no difference between the groups who were given bao versus another snack, on the hours spent in hospital, how much sleep the doctor got, or the number of admissions. The calls were equally “siong” (colloquial word for “taxing and busy”) and affording tired doctors just two hours’ sleep during a night call, no matter what you ate. But still the practice remains: after all, it’s better not to take risks and “jinx” the call.

So why are we so “unscientific” and superstitious?

First, some definitions: Superstition means “a widely held but irrational belief in supernatural influences, especially leading to good or bad luck, or a practice based on such a belief”. A related term, taboo, is “a social or religious custom prohibiting or restricting a particular practice or forbidding association with a particular person, place, or thing.” In this part of the world we tend to use the Malay term “pantang”.

From time memorial, human beings have sought to understand the world around them. Gradually, through observation and practice, our ancestors learnt about the cycle of the seasons, movement of the stars and moon and other natural phenomena, that enabled them to understand, predict and even harness these events to their advantage. Ancient peoples may not have known the scientific basis of the events, but they developed myths and legends, pantheons of gods, goddesses and other beings, as a way of explaining how the world worked.

But other phenomena and events are not so predictable, especially when it comes to natural disasters, illness, tragedies and other stressful, unpleasant and unfortunate experiences. Why did floods wash away my house and not my neighbour’s? Why, if the doctor said it was a one in a 1,000 chance, must I be the one to get it? Why was the night call so bad with so many ill patients admitted to the hospital?

There are no good answers to many difficult questions, but as human beings, we all need to make sense of our lives. When science has no answers, it should not be a surprise that we turn to rituals and traditions, superstitions and taboos. Anything that gives a sense of control over circumstances that are so daunting and unpredictable, must be better than nothing.

There are no good answers to many of these difficult questions, but as human beings, we all need to make sense of our lives. When science has no answers, it should not be a surprise that we turn to rituals and traditions, superstitions and taboos. Anything that gives a sense of control over circumstances that are so daunting and unpredictable, must be better than nothing. Our heads may say that this is not logical, but better not take chances...

In psychology, there is a concept called meaning-making, and refers to how we perceive and interpret what happens in our lives. Viktor Frankl, founder of logotherapy, was a psychiatrist who survived the horrors of the Holocaust, and whose work was very influential in this field. He described in his book, called “Man's Search for Meaning”, that every human’s motivation is to discover meaning in life. He posited that it is possible to find meaning in every experience, even the most wretched and painful ones, and that the process of finding meaning could be enriching and positive.

For patients and families dealing with the challenges of serious illness and the prospect of dying and death, the need to have some understanding and control, to make sense of an awful situation, becomes even more pressing. How each person chooses to construe his situation is unique, and entirely dependent on individual experience, personal beliefs and cultural and spiritual context. One person may believe that

his cancer was the result of black magic, another might blame secondary smoking, yet another view it as a punishment from God; that answer makes sense to that person. And that personal meaning then informs subsequent responses and coping approaches.

Those of us in palliative care who hope to provide patient-centred care, and accompany and support patients and families along the illness journey, must be prepared to “go to where the patient is”, to try and understand that person in that context. It is not our role to tell them how to think, feel or live their lives. It is however to help create space and opportunity for them to make their own meaning. How that “safe space of care” is created—through careful attention to the patient’s families and needs, physical and non-physical—and finding potential for growth and healing, is one of the defining attributes of palliative care.

Serious illness, suffering, dying and death can be frightening and disempowering, making it easy to feel helpless and swept along like one has no control. But we always have control, though it’s not over these issues.

It is not our role to tell them how to think, feel or live their lives. It is however to help create space and opportunity for them to make their own meaning. How that “safe space of care” is created—through careful attention to the patient’s families and needs, physical and non-physical—and finding potential for growth and healing, is one of the defining attributes of palliative care.

As Viktor Frankl had written:

Everything can be taken from a man but one thing: the last of the human freedoms—to choose one’s attitude in any given set of circumstances, to choose one’s own way.

When we are no longer able to change a situation, we are challenged to change ourselves.

Between stimulus and response there is a space. In that space is our power to choose our response. In our response lies our growth and our freedom.

Superstition

by Stevie Wonder (1972)

Very superstitious,
Writing's on the wall,
Very superstitious,
Ladders bout' to fall,
Thirteen month old baby,
Broke the lookin' glass
Seven years of bad luck,
The good things in your
past

When you believe in
things
That you don't understand,
Then you suffer,
Superstition ain't the way
Hey

Very superstitious,
Wash your face and hands,
Rid me of the problem,
Do all that you can,
Keep me in a daydream,
Keep me goin' strong,
You don't wanna save me,
Sad is the soul

When you believe in things
That you don't understand,
Then you suffer,
Superstition ain't the way,
Yeh, yeh

Very superstitious,
Nothin' more to say,
Very superstitious,
The devil's on his way,
Thirteen month old baby,
Broke the lookin' glass,
Seven years of bad luck,
Good things in your past

When you believe in things
That you don't understand,
Then you suffer,
Superstition ain't the way,
No, no, no



1. <https://www.annals.edu.sg/PDF/36VolNo3Mar2007/V36N3p217.pdf>.

2. <https://pubmed.ncbi.nlm.nih.gov/18392313/>.

Conversations Worth Having

BY THE PROJECT HAPPY APPLES 2021 TEAM



Project Happy Apples is a student-initiated project founded in 2012 that raises awareness about palliative care and sparks conversations about death in our society.

1. Ethan Maniam, a second-year medical student at NUS, featured in the first two videos of the Web Series sharing his experience coping with his grandfather's death.
2. Novia Long, a first-year medical student at NUS, featured in the first two videos of the Web Series sharing her experience caring for her late mother and coping with her death.
3. Dr Rakhee Yash Pal, an emergency physician at NUH, sharing how palliative care applies in the emergency department.
4. Michelle Lau, a medical social worker from Dover Park Hospice, sharing how she incorporates palliative care in her work to support patients and their families at the end of life.

As medical students, all of us have had opportunities to visit hospitals for our clinical attachments, where we often see patients and family members at the most vulnerable moments of their lives. As much as we can empathise with patients, their experiences can seem far-fetched and distant though they matter much more to the patients' loved ones than we could ever imagine. Some patients recover and go home, but for others, there is little hope for recovery. In the face of deteriorating health and impending death, not everyone is prepared to have those dialogues.

At Project Happy Apples, we want to help Singaporeans live a life with purpose and have a good death. This year, prompted by the COVID-19 pandemic, we replaced our traditional Public Exhibition with a Web Series. Having barely any experience with video production, the committee embraced the challenge head-on. The Web Series featured two medical students, Ethan Maniam and Novia Long, whose experiences in caring for their loved ones until the final moments prove how important it is to treasure every day spent with our loved ones. We also interviewed healthcare professionals in various specialties to learn more about their roles in providing palliative care for their patients.

Ethan and Novia's candid reflections make the impersonal personal—their sharing help us understand death from the perspective of a caregiver and a medical student. Both held regrets. For Ethan, it was not being more mentally present with his grandfather. "Spend

more time with your loved ones, and spend better time with your loved ones." We are encouraged to cherish the people we love a little more, and embrace the idea that the finite nature of life is, perhaps, what enables us to live life more meaningfully. Through our friends' moments of vulnerability, we are reminded that death is not an abstract topic to save for another day, but a pertinent one that requires urgency in facing.

We asked Novia, a fellow committee member involved in the Web Series production as well as an interviewee herself, how she felt throughout the whole project. She described it as a daunting experience when she first sat down in front of a camera and questioned if being vulnerable in front of her schoolmates, friends and strangers would be worth the effort. And it is. She received heartfelt messages from friends and comments from strangers expressing appreciation for her sharing, validating her journey. There is always a silver lining in every situation; if talking about her mother's death can make even one person take an honest look at their life and their choices, it could make all the difference. When we are vulnerable, we give others permission to push past the discomfort and do the same.

Interviewing a medical social worker and doctors of various specialties, we were given insights into how palliative care really looks like in clinical practice. It is about championing the quality of life for every patient, at any point in time of their disease, with or without active treatment. Moreover, it is about finding out what matters to the patient and supporting them physically,

Through our friends' moments of vulnerability, we are reminded that death is not an abstract topic to save for another day, but a pertinent one that requires urgency in facing.

spiritually and psychosocially as much as possible. As healthcare professionals, we should not wait until patients are really sick or approaching the end of life to have those conversations. One palliative care practitioner who watched the video found it "encouraging" to see healthcare professionals with no formal palliative care training, being open to discuss and consider the holistic approach of palliative care. We too, are optimistic that current and future healthcare professionals will appreciate the interdisciplinary nature of palliative care and be better advocates for our patients.

It's 2021. Who could have known that we would still be in this battle against COVID-19? Such is the unpredictability of life—one that makes it imperative for us to be more present for our loved ones and have open and honest conversations with them. There has never been a more critical time to take charge of your life and think about what you value the most.

If a conversation is hard, it is probably one worth having.

Scan to watch the Project Happy Apples Web Series on Facebook:



Medical Technologies Open Doors to New Possibilities

BY PROFESSOR ROGER FOO, ZAYED BIN SULTAN AL NAHYAN PROFESSOR IN MEDICINE, DIRECTOR, CARDIOVASCULAR DISEASE TRANSLATIONAL RESEARCH PROGRAMME, NUS MEDICINE, AND SENIOR CONSULTANT, DIVISION OF CARDIOLOGY, NATIONAL UNIVERSITY HEART CENTRE, NATIONAL UNIVERSITY HOSPITAL



We are hurtling towards a world that may be hard to imagine in a decade to come, just as someone from 10 years back would probably not have been able to envisage so many of the features of the world that we live in today.

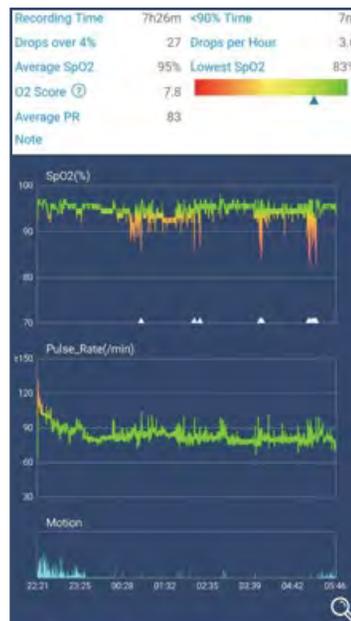
Last month, I bought myself a Wellue O2Ring¹ (Figure 1). On account of the research I have seen upfront from Professor Ronald Lee² of the National University Heart Centre, Singapore, the association between sleep apnea and cardiovascular disease is hard to ignore. Although causality evidence is still forthcoming, I am nevertheless concerned to find that I have what I think are a significant number of desaturation episodes during my sleep at night (Figure 2). There are physiological plausibilities that sleep apnea will cause or exacerbate hypertension or cardiac hypertrophy. The O2Ring markets itself as a

medical-grade oxygen monitor and it does fit comfortably on the thumb. I wear it in the night, and it monitors my pulse rate and O2 saturations silently without disturbing my sleep. What disturbs me instead is the numerous and consistent episodes of desaturations, although they have improved somewhat with a change in pillows and avoiding alcohol before sleeping.

But my own experience is not the message here. Rather, it is the ease with which we now have medically tested devices such as these, available not just to the medical profession, but to anyone who wants to monitor themselves, that is the focus of this article.



← Figure 1. The O2Ring fitted snugly on my finger.



← Figure 2. The data collected with the O2Ring from an overnight sleep. Top row represents Oxygen saturations and dips (desaturations), middle and bottom rows represent heart pulse rate and motion respectively.

Some time ago, I bought my 20-year old son another device called the Oura Ring³. This is a smart device that captures your day and night activity, steps, calories, heart rate variability, sleep cycle and more, integrating data into scores for “Readiness”, “Sleep” and “Activity”. You will have to investigate it to understand, but my son loves it, and many of his new age mates now wear one themselves. I hope the device doesn’t encourage a generation of hypochondriacs.

There is another piece of technology that particularly impressed me. Artificial Intelligence (AI) sets out to make decisions for man, at a scale that not only becomes ever more convenient, but more impressively, at levels that are inscrutable even to experts who have the knowledge. This is the proverbial black box, which is what AI is to me.

Data is fed into a machine learning system, and it looks for patterns so that decisions or conclusions can be generated for subsequent test samples. The innovative company called Eko⁴ now has an FDA-granted ‘Breakthrough’ designation for its electrocardiogram (ECG) based algorithm that screens for low ejection fraction to detect heart failure. Using paired ECG and echo data from over 44,000 patients at the Mayo Clinic⁵, the inventors trained a “convolutional neural network” to identify patients with ventricular dysfunction using the 12-lead ECG alone.

Reportedly, when tested on a subsequent independent set of ECGs from 52,000 patients, the algorithm yielded impressive sensitivity, specificity and accuracy. For patients without

ventricular dysfunction and a positive algorithm score, there was a four-fold increase in risk of developing future ventricular dysfunction. This is impressive. Not only does this tool simply need an ECG to tell if the patient has poor heart function, which is arguably easy to do if you have ready access to an echo machine in your clinic, but the tool also has predictive value to identify those who are not yet showing evidence of heart failure. I am keeping my eye on how this technology gets to clinical practice. Is it clinics or centres which do not have echo machines that will find this most useful for prioritising and diagnosing patients with heart failure? What is the minor ECG disturbance that is picked up by the algorithm, that escapes the eye of a cardiologist, that makes it possible for Eko to predict that someone is to have future heart failure?

Finally, Project InnerEye based out of Addenbrooke’s Hospital Cambridge⁶, looks like a collaboration between Microsoft Corporation and radiation oncologists, with an aim to automate quantitative analysis of 3D medical images. Imaging is key for a radiation oncologist to delineate and segment the tumour from healthy surrounding tissue with high precision, in order to plan for targeted radiation therapy. Delineating tumour boundaries is a painstaking and time-consuming procedure. As

an example of AI application to medical imaging, this project looks set to cut down manual operator time, significantly accelerate radiotherapy planning⁷ and cut through the bottleneck that slows down patient queues to their cancer treatment. The future is here.

It will be remiss for us in the medical profession to ignore expanding technology. Somewhere in the Nevada desert lies a large set of buildings that looks easily like an airport from a distance, or sci-fi designed towers and warehouses close-up, but in fact it is Switch, the world’s largest data company that stores data for Google, Amazon, Microsoft and all other tech giants. I have learnt that 90% of the world’s data was created in just the last two years alone⁸, and just one tech company (eBay) has generated more data (>100 petabytes) than all the books ever written in every language since the dawn of man (~50 petabytes). Data is collected on the choices we make, the places we go, the material we read, the goods we buy, the food we consume and much more. I think we are beginning to see the power of such data harvesting enter the realm of medicine and healthcare. The medical profession has the responsibility to keep ourselves centre and relevant in all the discussions and conversations around medical technology.



90%

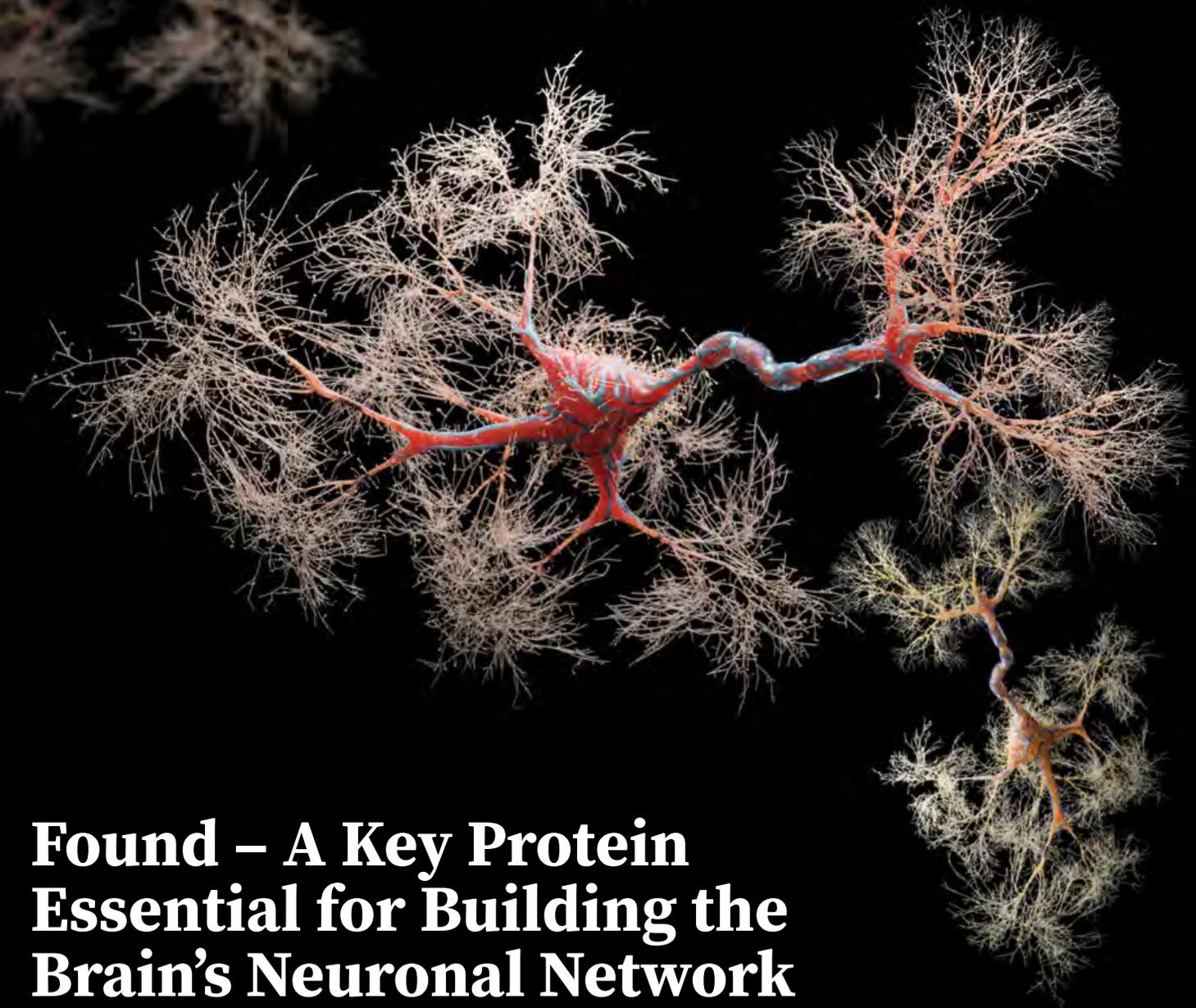
of the world’s data was created in the last 2 years



The >100

petabytes of data generated by eBay is more than all the books ever written in every language since the dawn of man (~50 petabytes)

1. https://getwellue.com/pages/o2ring-oxygen-monitor?gclid=Cj0KCQjw5PGFBhC2ARIsAIFIMNeNBnwQOdjOMolMeTYGZrOUJw6z7xjWpEtxhkQ_xMNAznzLxPulusAikMEALw_wcB.
2. <https://pubmed.ncbi.nlm.nih.gov/19497895/>, and others.
3. <https://ouraring.com/>.
4. <https://www.biospace.com/article/releases/fda-grants-breakthrough-designation-to-eko-s-ecg-based-low-ejection-fraction-screening-algorithm-designed-to-improve-detection-of-heart-failure/>.
5. <https://pubmed.ncbi.nlm.nih.gov/30617318/>.
6. <https://www.microsoft.com/en-us/research/project/medical-image-analysis/>.
7. <https://pubmed.ncbi.nlm.nih.gov/33252691/>.
8. Quote from Missy Young, CIO Switch.



Found – A Key Protein Essential for Building the Brain’s Neuronal Network

BY JOHN CHUA JIA EN, ASSISTANT PROFESSOR, DEPARTMENT OF PHYSIOLOGY, NUS MEDICINE

Those of you who might have been mischievous enough at some juncture to tinker around electrical wiring will not forget the jolt of electricity coursing through your finger as a result of accidental miswiring. Almost always, the sensation immediately triggers lively hopping around but the effect is fortunately transient and leaves little to no lasting repercussion.

Now, can you imagine what could happen if neuronal networks in our brain get miswired?

To understand this, one should first appreciate that neurons, the functional workhorses of our brain, are organised into functional cellular networks—but neurons do not begin life as part of a network. Analogous to

how a circuit board is created, immature neurons derived from neuronal precursors must send out cellular projections to make connections (synapses) with their designated target neurons to form the various neuronal networks that endow us with the means to sense, respond and permanently remember, for instance, that electric jolt.



Growing neuronal networks

For the sake of this article, and at the expense of some oversimplification, I highlight two requisite processes for neuronal networks to form. Firstly, growing neuronal projections must know where to go. Secondly, growth of the projections must be supported by a continual supply of biological raw materials.

The first process is accomplished via signals comprising chemical gradients secreted by target cells, known as guidance cues, that are picked up by receptors located at the tips of the growing projections (growth cones) (Figure 1A). During brain development, different neurons project to different areas of the brain. Complex arrays of guidance cue gradients generated across different brain axes ensure that billions of neurons are correctly wired up with each other to form both short- and long-range networks. Major guidance pathways involved in this process include guidance cues such as Netrins and Semaphorins and their associated receptors. Thus, migrating neuronal projections utilise guidance cue receptors located at their growth cones to sense Netrin

and Semaphorin gradients originating from the target cell regions (Figure 1A). Depending on which guidance cues are detected and the cell types they bind to, neuronal projections are then either steered (attracted) toward their targets or repelled from incorrect ones.

FEZ 1: The protein propelling healthy neuron growth

Now that they know where to go, these projections need to grow towards their targets to form connections (synapses). As mentioned earlier, growing projections require a constant delivery of new biological materials (also known as cargoes) to support their elongation (Figure 1A, inset). Enter the Kinesins, the biological motors responsible for transporting cargoes within cells. Although motors supply the driving force to move cargoes around, they also require additional proteins that enable them to recognise and carry their respective cargoes and to regulate transport. One such protein that is essential for both functions is fasciculation and elongation protein zeta 1 (FEZ1). Binding of FEZ1 to Kinesin regulates its activities and allows the motor to bind and transport their cargoes. We and others have shown that FEZ1 mutations severely disrupt intracellular transport and cause massive traffic jams in neuronal

projections. Incidentally, these abnormalities are associated with neurodegenerative disorders, such as Alzheimer's disease.

As with any viable business model, a good intermediary is required to ensure that supply meets demand. Thus, while it would seem commonsensical that guidance cues should liaise with the intracellular machinery to direct cargoes solely to regions of growth as neuronal networks form, how this is achieved and the identity of the intermediary connecting the two processes has hitherto been little known.

Our recent work¹ provides an important illumination regarding this knowledge gap by identifying FEZ1 as the intermediary in question. As mentioned earlier, attractive guidance cues such as Netrin-1 and Semaphorin 3a steer growing projections towards their neuronal targets. Remarkably, we observe that deleting FEZ1 expression in neurons not only blocked the ability of guidance cues to stimulate the growth of neuronal projections, it also severely stunted their growth (Figure 2)! These observations uncover miswiring events that occur in the absence of FEZ1, which is expected to disrupt the resultant neuronal network formed (Figure 1B).

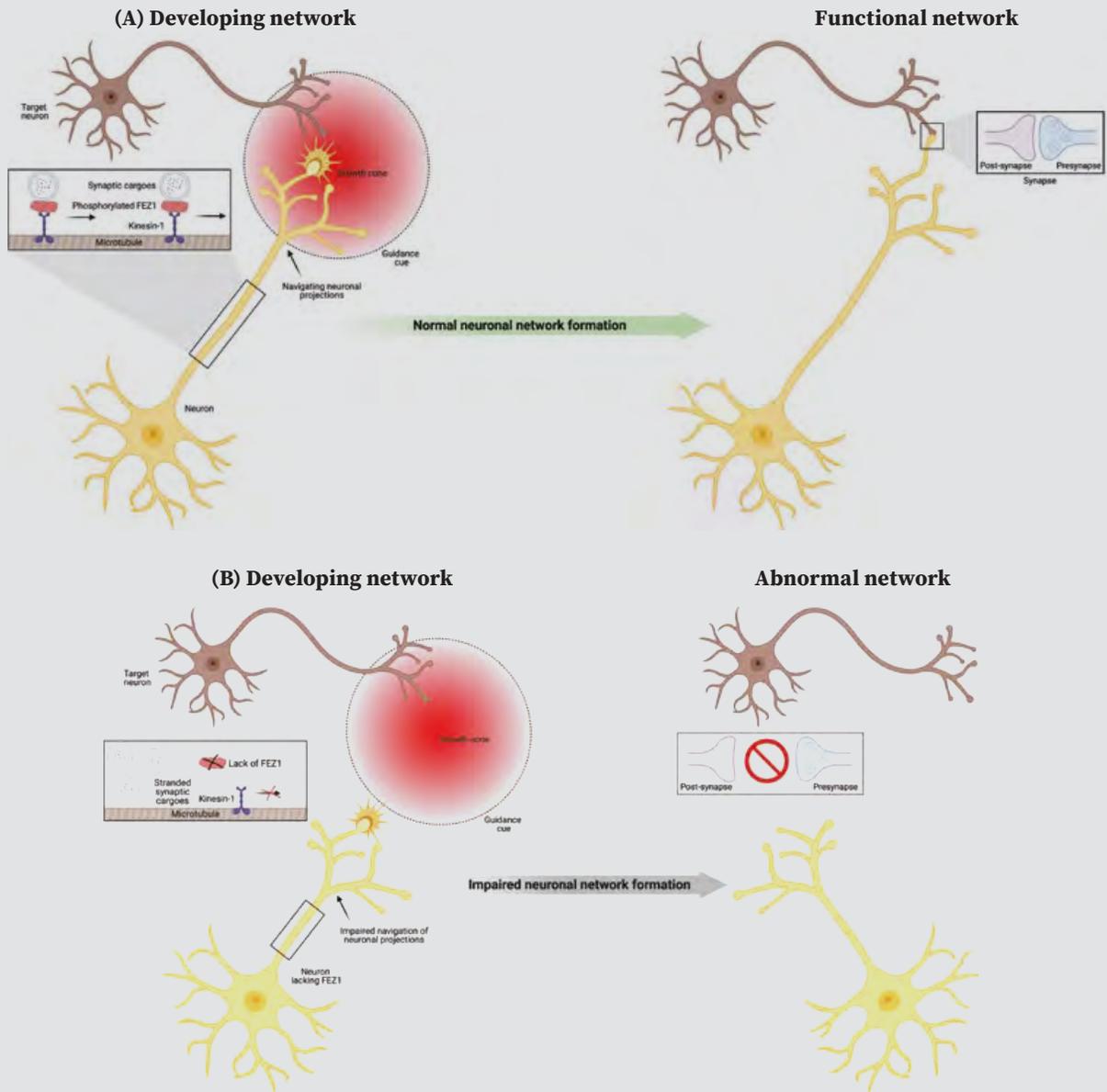


Figure 1. (A) Formation of neuronal networks during brain development requires guidance cues to help developing neuronal projections migrate to their neuronal targets. Upon contact, the projections form synapses to allow communication between the neurons. (B) Loss of FEZ1 disrupts communication between guidance cue signalling and the intracellular transport pathway. This, in turn, affects neuronal network formation during brain development.

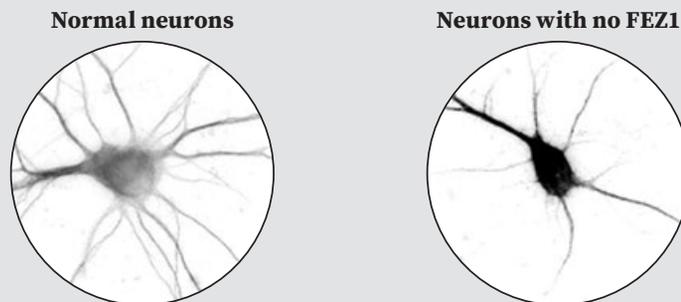


Figure 2. Left panel: normal neurons show proper development of neuronal projections. Right panel: neurons without FEZ1 show noticeably fewer and shorter projections reflecting abnormal development. Images modified from Chua et al., 2021.

Missing FEZ1 linked to mental health disorders

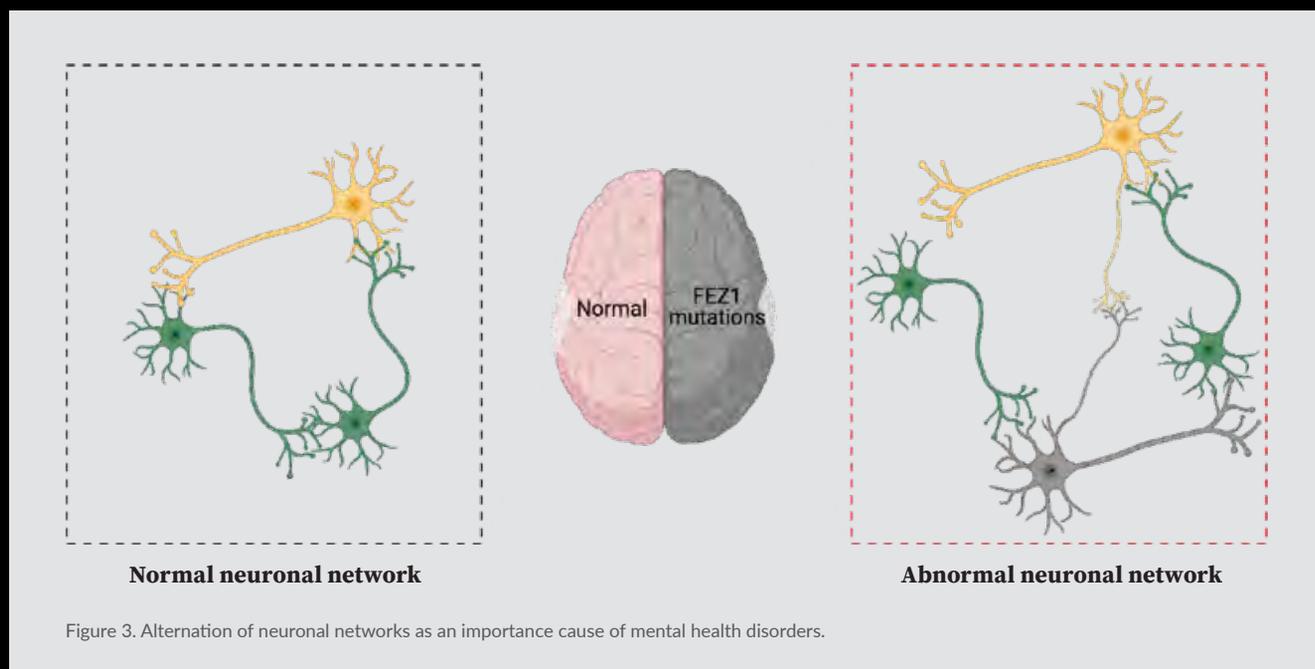
Significantly, neuronal network disruptions are thought to cause major mental health disorders (Figure 3). FEZ1 itself has been implicated in at least schizophrenia and attention deficit hyperactivity disorder (ADHD). The gene encoding FEZ1 is also frequently deleted in patients affected by Jacobsen Syndrome (JS), a rare chromosomal disorder where the terminal region of Chromosome 11q is deleted. Remarkably, behavioural abnormalities (related to ADHD, autism spectrum disorder (ASD) and, less frequently, schizophrenia) and cognitive deficits have been documented in JS patients, adding support to the notion that abnormalities in FEZ1 contribute to such disorders. These patients also exhibit psychomotor

impairments, including gross and fine motor delays. Of note, we recently demonstrated that FEZ1 deletion also causes delays in human motor neuron development². This indicates that its involvement in neuronal network formation extends beyond the central nervous system to participate in the formation of motor circuits.

Moreover, FEZ1 is involved in another important step of neuronal network formation—the formation of synapses (Figure 1A). We previously reported that loss of FEZ1 in neurons dramatically reduced the number of synapses (i.e., the number of connections formed between neurons). Furthermore, FEZ1-deficient flies show abnormalities in their neuromuscular junctions (synapses formed between motor neurons and muscles)

that correlated with movement disorders observed in these flies. These findings identify another layer of alteration to neuronal networks when FEZ1 function is compromised or lost.

Collectively, our findings highlight FEZ1 as a critical player in the formation of central as well as peripheral neuronal networks. It does so by acting as a convergence point to integrate key pathways involved in neuronal development. Elucidating FEZ1's functions uncovers but the tip of the iceberg in our efforts to define the complex and polygenic causes of mental health disorders. Building upon these efforts, we will progressively unravel and demystify the layers of complexity surrounding the origins of these disorders that will allow eventual development of targeted strategies to treat affected individuals.



1. Jie Yin Chua, Shi Jun Ng, Oleksandr Yagensky, Erich E. Wanker, John Jia En Chua, FEZ1 Forms Complexes with CRMP1 and DCC to Regulate Axon and Dendrite Development, *eNeuro* 26 March 2021, 8 (2) ENEURO.0193-20.2021; DOI: 10.1523/ENEURO.0193-20.2021.
2. Saravanan Gunaseelan, Ziyin Wang, Venetia Kok Jing Tong, Sylvester Wong Shu Ming, Rafhanah Banu Bte Abdul Razar, Sumitra Srimasorn, Wei-Yi Ong, Kah-Leong Lim, John Jia En Chua, Loss of FEZ1, a gene deleted in Jacobsen syndrome, causes locomotion defects and early mortality by impairing motor neuron development, *Human Molecular Genetics*, Volume 30, Issue 1, 1 January 2021, Pages 5–20, <https://doi.org/10.1093/hmg/ddaa281>.

Illustrations by Saravanan Gunaseelan, Research Fellow, Department of Physiology, NUS Medicine.

Musings of a Family Medicine Residency Programme Director

BY DR DAVID TAN HSIEN YUNG, FAMILY PHYSICIAN, SENIOR CONSULTANT, NATIONAL UNIVERSITY POLYCLINICS AND DIRECTOR, FAMILY MEDICINE RESIDENCY PROGRAMME, NATIONAL UNIVERSITY HEALTH SYSTEM

PHOTO:
Dr David Tan
(third from
left) teaching
residents.



I have been the Programme Director of the NUHS Family Medicine Residency Programme since July 2019, having stepped into the Associate Programme Director position a year before. The past few years have seen a shake-up in the healthcare sector which started with the re-clustering of the regional health systems into the current three integrated health clusters, and our residency programme has seen similar major changes with the rapid increase in residents being enrolled.

The NUHS Family Medicine Residency Programme is a three-year programme which has a vision of “Transforming Family Medicine, Nurturing Leaders” through its mission of “providing training across multiple disciplines, population groups and practice settings, so as to develop competent, collaborative, and compassionate Family Physicians who are lifelong learners and can meet the nation’s healthcare needs”.

Family Medicine residency training is quite different from many of the other specialty programmes in the breadth of training that our residents are exposed to via the specialty departments and practice settings that they rotate through, and this is therefore dependent on the ‘hospitality’ of departments in taking in our residents and training them. This three-year programme culminates in the final exam after completion of training where graduates will attain the Masters of Medicine (Family Medicine) conferred by NUS.



About the NUHS Family Medicine Residency Programme

3-year
programme

Intake of
30
residents per year

Residents go
through
3-month
block posting with
Private General
Practitioner
partners

The uniqueness of our programme lies in the culture of the NUHS cluster which has an emphasis on academic and research excellence. We pride ourselves on having a dedicated and committed faculty, exposing our residents to a range of postings with immersive hands-on experiences, and exposure to the private primary care sector with a three-month block posting with our private General Practitioner partners. Beyond that, our residents receive in-depth training in the community hospital setting with close supervision by our own faculty, and of course, longitudinal training in their continuity clinics and postings with the National University Polyclinics.

Rapid expansion of the programme

I took on the position of Family Medicine Programme Director at a time when the programme was undergoing rapid expansion, as we increased intake from six residents per year to the current intake of 30 residents. Thankfully the good work by my predecessors, Associate Professor Goh Lee Gan and Associate Professor Tan Boon Yeow, gave a good structure and foundation to the programme, though the increase in residents meant having to renegotiate with the existing departments hosting Family Medicine residents and engaging new departments within the cluster to take in and train our residents.

One thing I have learnt since being involved in the programme is *how to kayak!* All NUHS residents go for a residential Outward Bound Singapore (OBS) experience, where they go through a three-

day paid vacation on Pulau Ubin to learn about teamwork and resilience through activities which include high element training, water activities and puzzle solving. A shared experience with the OBS instructors was how they had to similarly undergo a rapid expansion of their own programme due to compulsory inclusion of OBS into the secondary school curriculum. The issues of dealing with an increased number of learners, recruitment of instructors (faculty) and maintaining standards resonated with me.

Of course our own expansion of the programme brought about its challenges, with some specialty departments requesting a limit to the number of Family Medicine residents posted to them as this would result in less medical officers from the MOPEX pool (Medical Officer Posting Exercise) allocated to them, despite Family Medicine residents being funded more by Ministry of Health (MOH). We have also had to deal with hospital specialists who prioritised training places in hospital-run courses for their own trainees, despite Family Medicine residents technically being in the same cluster. Despite this, I have been heartened by the support shown within the cluster with other specialists stepping up to offer teaching sessions for our residents on their own accord and figuring out ways to squeeze the increased

numbers of residents into their own departments. The Family Medicine fraternity itself has stepped up to the challenge, with existing family physicians and alumni of our residency programme coming in as new faculty to pay it forward to generations of residents after them.

Pandemic problems

COVID-19 has been a great disruptor to our usual way of doing things, and the Family Medicine residency programme has faced similar challenges. When the pandemic first hit our shores and Singapore moved from DORSCON Yellow to Orange in the first half of 2020, we had to scramble to relook at the postings of our residents as there were suddenly restrictions placed on how they could rotate from department to department, whether it was within the same institution or across campuses. While some other programmes made the decision to pull residents back to the polyclinic during the heightened measures, my priority was to try to keep to the residents' planned rotations as much as possible, as these would be opportunities lost and hard to reclaim in the short three-year programme. It became almost like solving a puzzle in itself, having to quickly adjust residents' planned rotations so that they could still do so albeit within MOH's directive of allowed movements for healthcare workers.

“The Family Medicine fraternity has stepped up to the challenge, with existing family physicians and alumni of our residency programme coming in as new faculty to pay it forward to generations of residents after them.”



Apart from the impact on rotations, COVID-19 has also affected how we deliver much of our centralised teaching sessions, with the programme having to pivot to a virtual format using the Zoom platform. While we see benefits in that residents can now tune in from their various workplaces or homes for the sessions, this has also meant that our programme as a whole has not met up in person for the past year and a half. We long for the time when we can actually see all our residents in person, as a collective group.

Keeping in touch

There is an increasing emphasis being placed on the well-being of our learners, and more emphasis is being given to issues such as burnout in our residents. In order to keep the channels of communication open between faculty and residents, the programme has instituted various measures. Residents are assigned individual Family Medicine

supervisors who track their progress along the three-year programme. Quarterly meetings with the resident leadership (consisting of a Chief Resident, three Assistant Chief Residents and three Class representatives) allow in-depth discussion into the issues plaguing the residents and suggestions for improvement to the programme. In addition, an annual review of the programme occurs with resident representatives invited to the Programme Evaluation Committee meeting.

On top of that, I started a WhatsApp chat group with all the residents and their Programme Directors to disseminate information and share my thoughts about Family Medicine and other ongoing issues. I can only wonder if the residents find that helpful or an intrusion into their daily lives!

Going forward and wishes for the future

Family Physicians are and always will be the foundation of

any high performing healthcare system, and the NUHS Family Medicine Residency Programme will always endeavour to develop well-trained Family Physicians in the community who can manage a breadth of conditions and collaborate with their hospital colleagues for patient care and improving the health system. I do hope that our hospital colleagues will be farsighted and see training Family Medicine residents as an investment for the future, where patients currently being managed in tertiary care can be taken over by these young doctors that they have trained, hence reducing the load on the hospital systems.

And as our residents graduate and permeate into the different areas of the healthcare system, we can truly trust that the best is yet to be, and this can only bode well for Singapore’s healthcare system!

↑
 NUHS Family
 Medicine Residency
 Faculty is growing
 in numbers.

Images were taken before implementation of COVID-19 safety measures.



Compassion – An Ethical Imperative

*BY ASSOCIATE PROFESSOR ROY JOSEPH,
DEPARTMENT OF PAEDIATRICS AND CENTRE FOR BIOMEDICAL ETHICS, NUS MEDICINE
UNDERGRADUATE DIRECTOR, HEALTH, ETHICS, LAW AND PROFESSIONALISM (CURRICULUM)*

The emotional and mental toll of COVID-19

During the course of last year, Singapore and Singaporeans have been perceived by many as a nation and a society that in an exemplary manner continues to engage and overcome the challenges brought on by the COVID-19 pandemic. In his 7 May memo, Professor Yeoh Khay Guan, Chief Executive of NUHS, stated: “We have grown stronger through every challenge that COVID-19 has thrown our way, and our duty to care has always prevailed. I have every confidence that we will rise to the occasion once again.” Our current distinct change in the local epidemiology of the disease has brought us, in the words of Minister Lawrence Wong, the Co-chair of the Multi-Ministry Taskforce, to “a knife-edge” situation. This precarious position is a reminder that the pandemic and its ramifications will be with us and continue to challenge us for some more time and in new ways.

As a medical school, we too have collectively kept our eyes on our mission and through humility, solidarity, diligence, resilience and perseverance prevailed and succeeded in delivering about another 300 doctors to society, inducted a similar number into the medical school and enabled another 900 to progress in their studies. Being in a constant state of having to do more and be better requires intense and prolonged devotion and demand on each of us as individuals. This is likely to have caused and continue to be causing subtle ill effects in any or all realms of life—physical, emotional, social, mental and spiritual.

Each day is one of heightened vigilance, with no time for others. One ends as the day



300
doctors successfully graduated from NUS

300
students were inducted into NUS Medicine

900
doctors-to-be remain on track in their studies

ends, having accomplished much, tired but not happy and with a sense of relative isolation from other people. Any of these ill effects can easily push us into a mood of dissatisfaction and disappointment. When physical symptoms and emotional exhaustion are accompanied by a sense of alienation from work-related activities and reduced performance, burnout is probably present.

Media reports and academic publications confirm and provide details of these ill effects and their prevalence¹. When we are persistently in such a state, the person slides into the physiological survival mode. In this mode, the reactionary thoughts, emotions and actions that prevail will tend to be ones that serve self-preservation. In the long term, remaining in such states of anxiety, dissatisfaction and disappointment can gradually dehumanise us because we lose emotional agility.

The tendency is for us to adopt a mood of resignation and this may lead the individual to stop taking care of self and others because it is concluded that the

person can't make a difference. We then become numbed and subsequently indifferent to what is happening in and around us. One manifestation of this loss or blunting of emotional agility is the inability or difficulty to feel compassion for self and others. In this article, I aim to describe the critical role of compassion especially among healthcare professionals and the need for compassion to remain active in us so that we can continue to fulfil our professional responsibilities ethically.

Compassion and its role

Compassion is defined as the emotional response to another's pain or suffering, involving an authentic desire to help. It differs from empathy which is the feeling and understanding of another's pain or suffering. Empathy often precedes but may not always lead to compassionate action. Likewise, compassion differs from altruism, which is action to benefit another but not self. Altruism may or may not involve empathy or compassion.

Compassion, according to Darwin, protects the species and has an evolutionary origin.

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Hence it is not surprising that it is also part of the different world religions and cultures. Medical interventions will in most instances, restore function but not necessarily health. Compassionate care is needed for the restoration of the health of the sick. When we are compassionate to those who come to us for succour, we enhance through well-established physiological mechanisms their recovery and healing. There is empirical evidence that compassion brings physiological and psychological benefits to the patient. It has also been shown to motivate patient self-care and promote healthcare quality.

The benefits of compassion go beyond the patient, cutting healthcare costs and generating revenue². Compassion is thus a critical attribute required of all healthcare professionals because it has a strong ethical grounding. It contributes to beneficence, minimises harm and is respectful of the patient. With its ability to especially reduce costs, compassion may also be seen to be upholding the ethical principle of justice. That is why it is enshrined in our Ethical Code³: “...be dedicated to providing medical care that is competent, compassionate...”, and the Ethical Guidelines “...must provide competent, compassionate.... to your patients”. Hence it is vital that medical students and their teachers recognise this requirement and learn how to be compassionate in all circumstances.

Unfortunately, research indicates that compassion in healthcare professionals has generally been found to be falling to low levels⁴. How can we become more

There is empirical evidence that compassion brings physiological and psychological benefits to the patient. It has also been shown to motivate patient self-care and promote healthcare quality.

compassionate to ourselves? I believe it requires humility to look at self. Compassion for self, requires firstly the recognition of personal suffering, failing or sense of inadequacy, accepting the inevitability of these because as humans we are imperfect and cannot be at our best all the time, and then being kind, warm and understanding to ourselves. This acceptance is key to emotional equanimity.

Secondly, we need to see our experience not in isolation but as part of the shared human experience—“It’s not me alone who is suffering”. Finally, in a non-judgemental and receptive state, we must set aside time to engage our non-suppressed or exaggerated feelings and thoughts. This can be facilitated by relating personal experiences to those of others and thereby obtaining a wider perspective⁵. This balanced or mindful approach to our situation will result in responses opened, shaped and calibrated by ambition, rather than being limited by resignation.

There is a myth that compassion is difficult to provide in real life, because it is time consuming. A study has shown that just 40 minutes is sufficient for an informed and trained healthcare professional to become compassionate to a patient⁶. This is because that’s all the time that is required to prepare ourselves to be able to

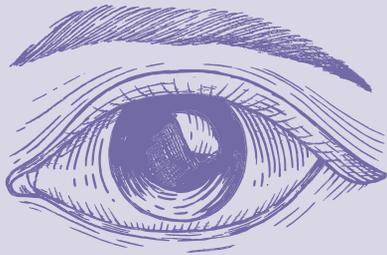
listen and feel for the suffering, empathise by acknowledging it and validating the impact and then to declare sincerely, our compassionate response to journey with and support the other. For the medical teacher and the student, the same applies. In our present times, both teacher and student may be hurting and suffering in various ways. As stewards we have a collective and an individual responsibility to compassionately care for each other as we address our academic responsibilities.

In conclusion, a deeper understanding of the attribute of compassion has been introduced. The critical need for its prominence in the life of the teacher and the student is suggested and a practical framework for its development and internalisation is offered.

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The Eye



Surgeon's Art –



A Matter

of Heart,

Hands

and



Ears



*BY DR LOON SENG CHEE, SENIOR CONSULTANT,
DEPARTMENT OF OPHTHALMOLOGY, NATIONAL
UNIVERSITY HOSPITAL*

The alumnus from the Class of 1994 gives a glimpse into his work with patients with glaucoma and other eye conditions.

Doctors will tell you that every discipline attracts people with different personalities. As eye surgeons, we are firmly in the camp of the doers. Sometimes we focus too much on the problem at hand—strive for solutions and fix the problem. We tend to focus on that rather than the entire person. I might have been headed that way too, but for a certain twist of fate early on in my career.

I met a Human Resource officer at Ministry of Health when I was a new doctor one day. He asked me what I wanted to do. I jumped at the opportunity, telling him about my grand plans to be a great eye surgeon, save eyes and such. He smiled and said, “But your name is Loon! You should be a psychiatrist!” and honest to goodness, before you know it, I was sent to Woodbridge Hospital in my inaugural posting as a medical officer, where I spent the next six months. Later, during my National Service days, I spent the next two years doing psychiatry. It was not all for nothing mind you: one of the things I learnt was to listen.

And for someone who is objective driven, it may not come as second nature. You learn to listen to your patient for hours on end, then work with the other team members like the occupational therapist, medical social worker and the nursing team to help keep the patient mentally and physically well, and engaged with society.

So as much as I rely on my hands to help patients, sometimes it’s the ears that

“It’s a long term journey—it’s important to treat the disease and the sufferers, and listen to their needs whilst providing suitable solutions along the way, that involve eyes, ears and hands.”

make the difference, even in a discipline like glaucoma. Glaucoma is a feared disease, and yet, there is not enough awareness of it.

An elderly patient I saw recently almost cried in relief when I told her that she does not have glaucoma. The weight off her shoulders was almost palpable. To her, getting this potentially blinding disease was akin to getting a death sentence. And she is not the only one. Surveys have shown that people are more willing to lose a limb, or even lose their lives than go blind. This is how many people feel about getting glaucoma, but it does not have to be this way.

In our world of instant gratification, we often look for solutions which are fast, and one-off, but glaucoma is a disease that is not addressed with a single pill, or a solitary surgical solution. It is analogous to hypertension, which can be controlled, but you don’t really eradicate the problem. So it’s a long term journey—it’s important to treat the disease and the sufferers, and listen to their needs whilst providing suitable solutions along the way, that involve eyes, ears and hands. Here are the stories of a couple of my patients.



The Angry DJ

My first story is about a young man, who had diabetes and glaucoma. When I saw him, he was working as a DJ and bartender, working late into the night, with little concern for his health. He drank a lot, ate like there was no tomorrow, and smoked like a chimney. By the time he was 25, he had lost vision in one eye, and had multiple treatments for his condition elsewhere. He was angry with life, the various restrictions on his diet, the many clinic visits to various doctors, and the frustration of having to use many types of medications.

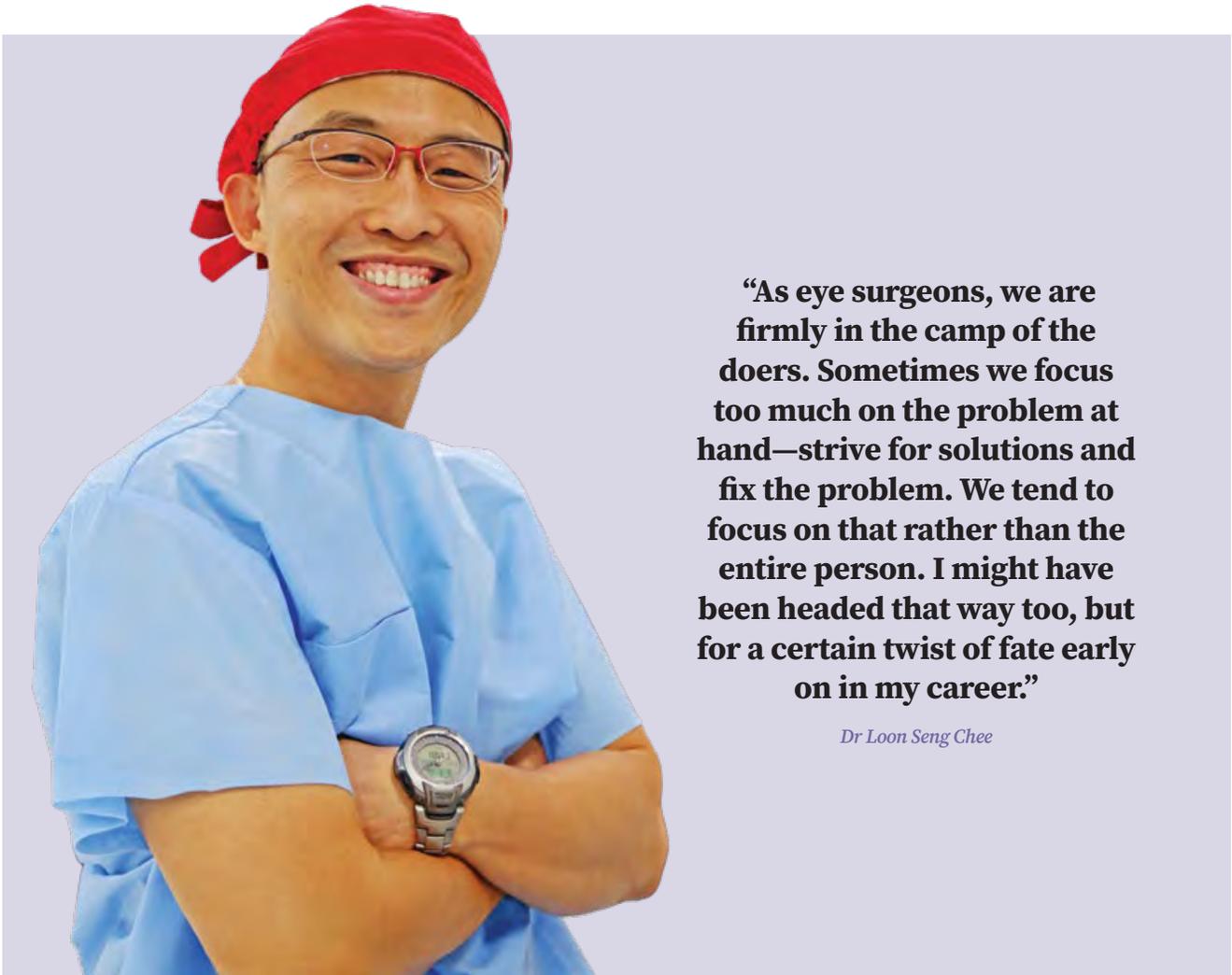
So I took a multifaceted approach to this young man. I put him in touch with our dietician, to help him manage his meals, then simplified his medications, both oral and eye drops, especially since he had poor vision at one point in both eyes.

Most importantly, I tried to listen, so I could find out what made him tick and potentially motivate him to get his treatment. As he enjoyed being a DJ, I convinced him that if he got treated, he would be able to see well enough to continue with what he loved doing.

Then after all that, we began to work on his eyes, with lasers, and

more surgeries. These were painful and there were many long hours in the clinics, operating theatres and rehabilitation. But now I could see light in his eyes and occasionally a smile even.

I saw him recently. He has retained good vision in his left eye, no longer needs eye drops and has adopted a healthier lifestyle. He has also taken up a part time job with the Health Promotion Board as a social distancing ambassador during the downtime experienced by people employed in the entertainment and leisure industry. Despite the current challenges, he remains optimistic and takes the COVID-19 crisis in his stride.



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Dr Loon Seng Chee

Diabetes and glaucoma

Diabetes is the bane of the modern world, with significant numbers of people in Asia and elsewhere succumbing to this metabolic epidemic. Like glaucoma, you may not feel much is wrong in the early stages but when the complications occur, there are many serious consequences. In many serious cases, the eyes are affected and this can result in a form of glaucoma known as neovascular glaucoma, which can be difficult to treat.

Thankfully, modern medicine has meant this disease can be managed. But the treatment needs a partnership between the patient, his medical doctor and the eye surgeon. Similarly, congenital glaucoma is another long journey for both patient and caretakers.

The boy with an endless supply of smiles

This boy was born without an iris, a condition called aniridia. He had eye pressures that could not be controlled with eye drops. As with most cases of congenital glaucoma, surgery was required very early on in his life. Despite living with rather poor vision, he remained cheerful and playful.

I met his mum, and explained that it would be a lifelong journey together for both the child, the mother and the doctors looking after him. And there would be many operations, the need for medication. Long after I have retired from practice, this young boy will continue to require care.

Even though the mother had already seen a few doctors, and was probably aware of the gravity of her son's condition, it still took a while for everything

I told her to sink in. But both mother and child are blessed with one quality that will serve them well throughout their lives: a bright, positive disposition.

When I first saw the child, he greeted me with a megawatt smile, and had one of those faces which could get away with murder. He prefers females to examine him, so I knew he had some decent vision because he could definitely discern that I most certainly was not one!

Examining a child takes extra patience, and a lot of cajoling. You soon learn to contort your body into various positions to enable you to examine the writhing little body who believes that there is a contortionist residing in every eye surgeon. You have to set some time aside, and some days, despite your best efforts, a child can prove too fretful to examine. A good warm up with comprehensive stretching, some muscle rub after and a good cup of coffee are all part of the routine involved in examining him. Just think of that song "I like to move it, move it" and play it back at twice the regular speed.

Ultimately, with rising eye pressures, we had to perform surgery and typically we operated on one eye at a time, and allow it to recover before we go on with the other eye. It is important to involve all caregivers as they will be the ones who will administer the eye drops for the child, as well as to take care and keep the child from touching or rubbing his eye post-surgery. I always share with both patients and their parents that once you embark on this journey, it's a long-term partnership to care for the child.

**About the Glaucoma**

Glaucoma is a blinding disease often with no symptoms. It is not addressed with a single pill, or a solitary surgical solution. The treatment needs a partnership between the patient, his medical doctor and the eye surgeon.

When the young boy first came, he was in pain, his vision was poor and the eye pressure was rising. It was important to listen to the worries that the mother had, then try to help her manage the care of the child, and finally plan for the surgeries the boy required.

Thus far, he has had three surgeries, including a cataract operation. Soon, we will schedule mother and child to talk to our occupational therapist in our low vision clinic to optimise what remaining vision he has. He is starting school, and continues to live a full life, which is vital for both his physical and mental health. He has a younger sister, who is thankfully normal and the mother has taught her children to look after one another so that the boy is assured of a buddy on his lifelong journey.

There are many challenges that lie ahead for the boy, but he is blessed with a sunny disposition and the support of a mother who will never give up on him. And that always makes my day even though I often get a sore back from trying to examine him in the clinic.

Glaucoma is a blinding disease, often with no symptoms. Even so, it can be treated. Through the quarter of a century of practice thus far, I have journeyed with many patients and learnt a lot about listening and more from them. Together, I believe there is light at the end of the tunnel, and that vision of hope will not be extinguished.

This is an edited version of a commentary that was first published in TODAY on 19 March 2021.

NIC Art for Kids – Disrupting Cancer, Restoring Lives

BY NG HWEI KOON, NUS MEDICINE INTERNATIONAL COUNCIL (NIC)

Proceeds from the charity donation and art auction will go towards improving the cure rate for children with cancer.



A big thank you to Mrs Elisabeth de Rothschild (pictured on the left with a portrait of Steve Jobs) and all donors for their generous contributions.

In circle:
Financial Times Editor Ms Roula Khalaf with the winning number she picked out for the raffle.

raise funds for research that Assoc Prof Yeoh was deeply involved in—innovation and research to “disrupt cancer and restore normalcy and life for children with cancer”. He explained, “In doing so, we also become a beacon to Asia and the region. Eventually, the knowledge and capabilities that (we build) will translate to better cure (for kids with cancer) everywhere in the world.”

It was a meaningful cause that Financial Times Editor Ms Roula Khalaf was delighted to be part of, to “make a very small contribution to this global effort against childhood cancer, which builds cultural bridges at the same time”. She was the Guest-of-Honour at the raffle-cum-charity donation drive and picked out the lucky raffle winner. The winner, Mrs Elisabeth de Rothschild, won a Steve Jobs’ painting donated by Dr Razuok. She and many donors had contributed generously to raise funds for the paediatric oncology department at NUS.

NIC Chairman Professor Kishore Mahbubani, who hosted the online draw event in the midst of the global pandemic, was struck by Ms Khalaf’s note that more than 80% of children with cancer were cured in high income countries, whereas in the lower income countries, only about 20% were cured. He highlighted, “That’s a very sharp discrepancy. It shows that if you can spread what you’ve done in the developed world to the developing world, the number of lives we can save through exercises like these, is very significant.”

When a child is diagnosed with cancer, the lives of everybody in the household gets affected. Parents’ work routines are disrupted, the child and siblings’ schooling may be upended. For paediatric oncologist Associate Professor Allen Yeoh, that was what the word “disrupted” meant to him, as he mused over the “Disruptors” exhibition and auction of artwork, organised to raise funds for child cancer research.

In September 2020, a series of paintings by renowned Lebanese humanity painter, Raouf Rifai,

was first exhibited at The Fullerton Hotel Singapore with the support of NUS Medicine International Council (NIC) members, Mr Daryl Ng of the Ng Teng Fong Charitable Foundation and Dr Assaad Razuok, Chairman and Chief Executive Officer of Sindicatum Renewable Energy, and art enthusiast. The works included portraits of internationally acclaimed innovators such as Jeff Bezos, Sergey Brin, Bill Gates, Steve Jobs, Yayoi Kusama and Mark Zuckerberg, among others.

Rifai’s paintings were subsequently displayed in late 2020 at the NUHS Tower Block to



To contribute to this effort to help improve the cure rate of children with cancer, email nic@nus.edu.sg to purchase a painting. Or to make a tax deductible cash contribution, scan QR code:

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NUS Medicine is proud to present our first-ever graphic novel "White Coat Tales". Richly illustrated with references to actual locations in the School, this manga offers a rare, intimate peek into the struggles and triumphs of five medical students — Divya, Yao Quan, Paul, Samantha and Shafia who overcome personal demons and ultimately, make the transition from learners to healers.



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