

MediCine



A publication of the Yong Loo Lin School of Medicine ▪ Issue 22 / May 2017

**CELLULAR
IMMUNOTHERAPY:
HARNESSING THE BODY'S
DEFENSES AGAINST CANCER**

DEAN'S MESSAGE



Dear Readers,

I am pleased to tell you that, for a second year running, NUS is ranked Asia's leading university, according to the 2017 Times Higher Education (THE) Asia University Rankings.

As NUS President Tan Chorh Chuan noted, the ranking is a strong recognition of the University's Asian and global approach to education and research, as well as the importance NUS places on making a positive impact on the nation and the community around us.

Like the other faculties and schools, the NUS medical school exists to serve Singapore. We have been doing this for the past 112 years by educating and training generation after generation of motivated medical and nursing professionals, teaching them to care competently for their patients. We are also driven by our relentless search for better, more effective ways to understand, treat and overcome diseases.

The healthcare profession is fundamentally about people and caring for them compassionately. This is also the philosophy of our School and we will inculcate this in the

incoming Medicine and Nursing Class of 2022, as we have done for preceding classes of medical and nursing freshmen. Our administrators also carry these values with them in their outreach to the needy, lonely and neglected through the School's corporate social responsibility initiatives.

The School has been able to perpetuate and uphold our Hippocratic ethos because it is blessed with a cadre of dedicated teachers, who are also doctors and scientists. They model and exemplify to all of us here at NUS Medicine the professionalism and humanity that we seek to imbue in our students and, indeed, in all of us.

That is why I want to place on record the School's deep appreciation and gratitude to Professor Hooi Shing Chuan, Vice-Dean (Education) and Associate Professor Lee Yung Seng, Vice-Dean (Academic Affairs), who are completing their respective terms of appointment. They showed the way for all of us, and NUS Medicine is a better and stronger institution because of their exemplary leadership.

Khay Guan

CONTENTS

DOSSIER

- 04** The Mountains are Calling and I Must Go
- 07** Getting the Young to Teach Their Elders about Health
- 10** Family Medicine Celebrates Three Decades of Service
- 11** Advances in Paediatric Oncology
- 13** Gathering Synergy in Dialysis Access Care
- 15** Interdisciplinary Teams, Out-of-the-Box Solutions
- 16** Human Well-being and Security in 2030: The Critical Role of Innovation
- 17** Second Generation Tanoto Continues Parents' Legacy

SCIENCE OF LIFE

- 18** Cellular Immunotherapy: Harnessing the Body's Defenses Against Cancer
- 20** Daily Cuppa Keeps Dementia at Bay
- 21** The Tao of the Clinician-Scientist

IN VIVO

- 27** The Future of Medicine
- 30** The First Full Professor of Family Medicine Has Big Plans for Teaching and Research at NUS
- 32** Fulfilling Her Nursing Dream

PEOPLE OF NUS MEDICINE

- 35** A Passion for Yoga

INSIGHTS

- 36** Poor Sleep Quality and Depression Could Trigger Dementia
- 38** Being a Caregiver

ETHICALLY SPEAKING

- 41** Justice as a Lens for One Health in Managing Emerging Infectious Diseases

SCHEDULER

- 43** May – July 2017

27



07



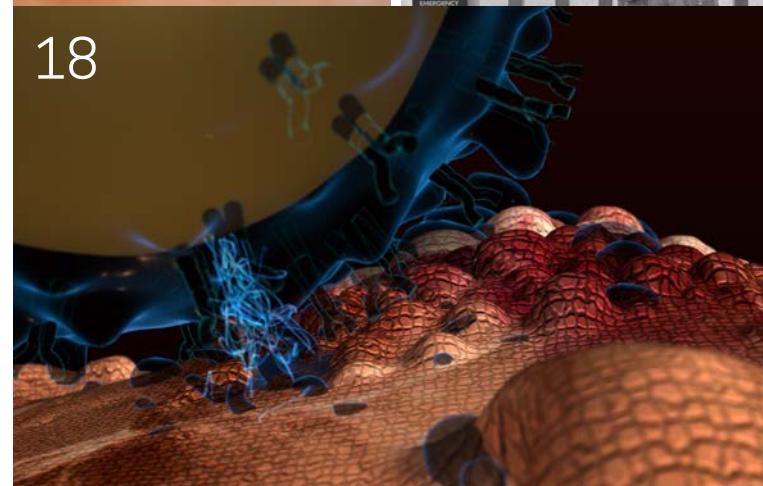
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18



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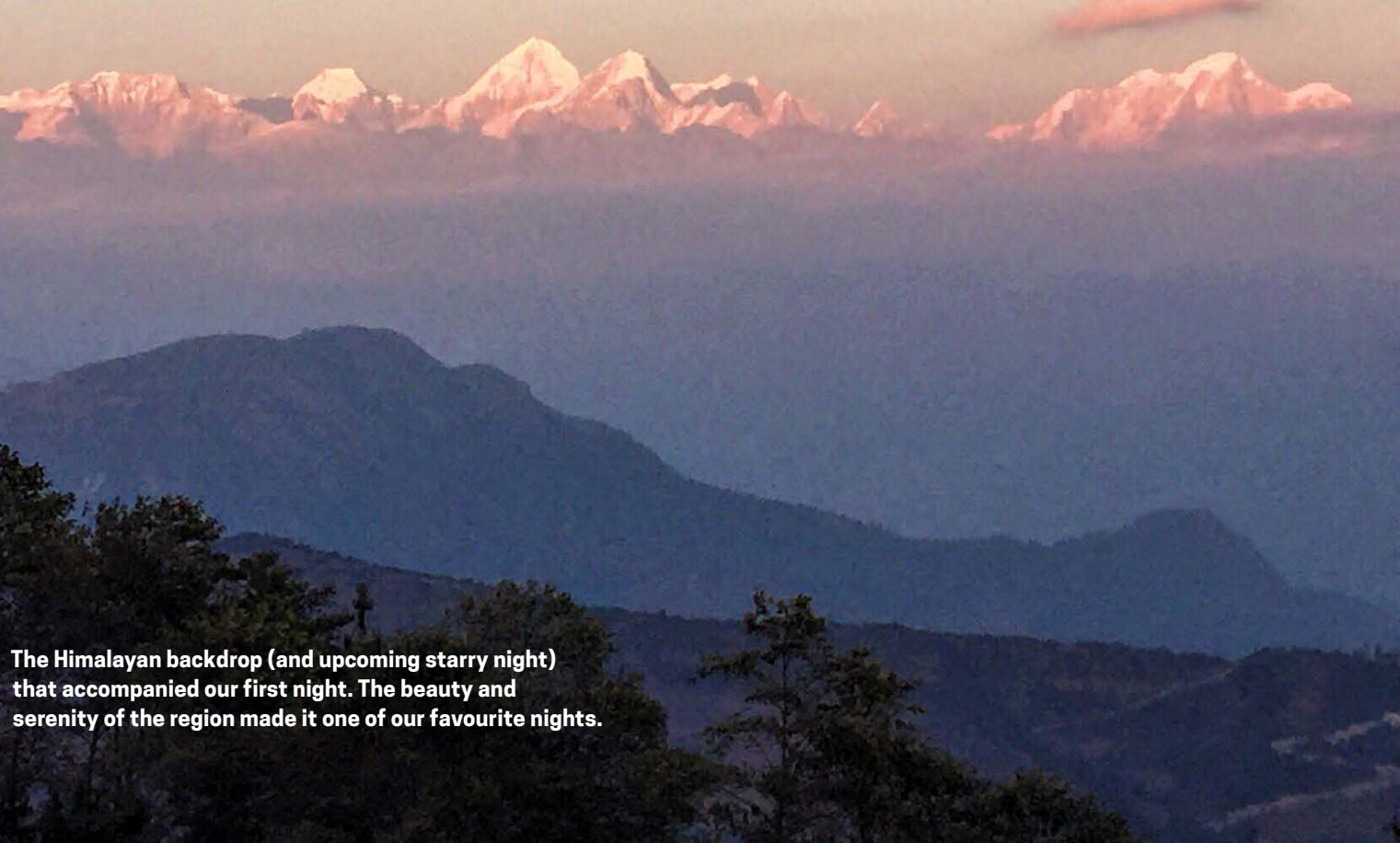
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THE MOUNTAINS ARE CALLING AND I MUST GO

“Mental Muscle” is a project started in 2015 by a group of NUS medical students. It aims to raise public awareness of mental illnesses that burden Singaporeans, as well as the need for social support for these individuals. The project also aims to help dispel stigmas that are applied to such patients and their illnesses. By completing in a grueling desert ultramarathon in Namibia in December 2016, the founding group of students successfully raised more than \$56,000 for the Singapore Association for Mental Health (SAMH).

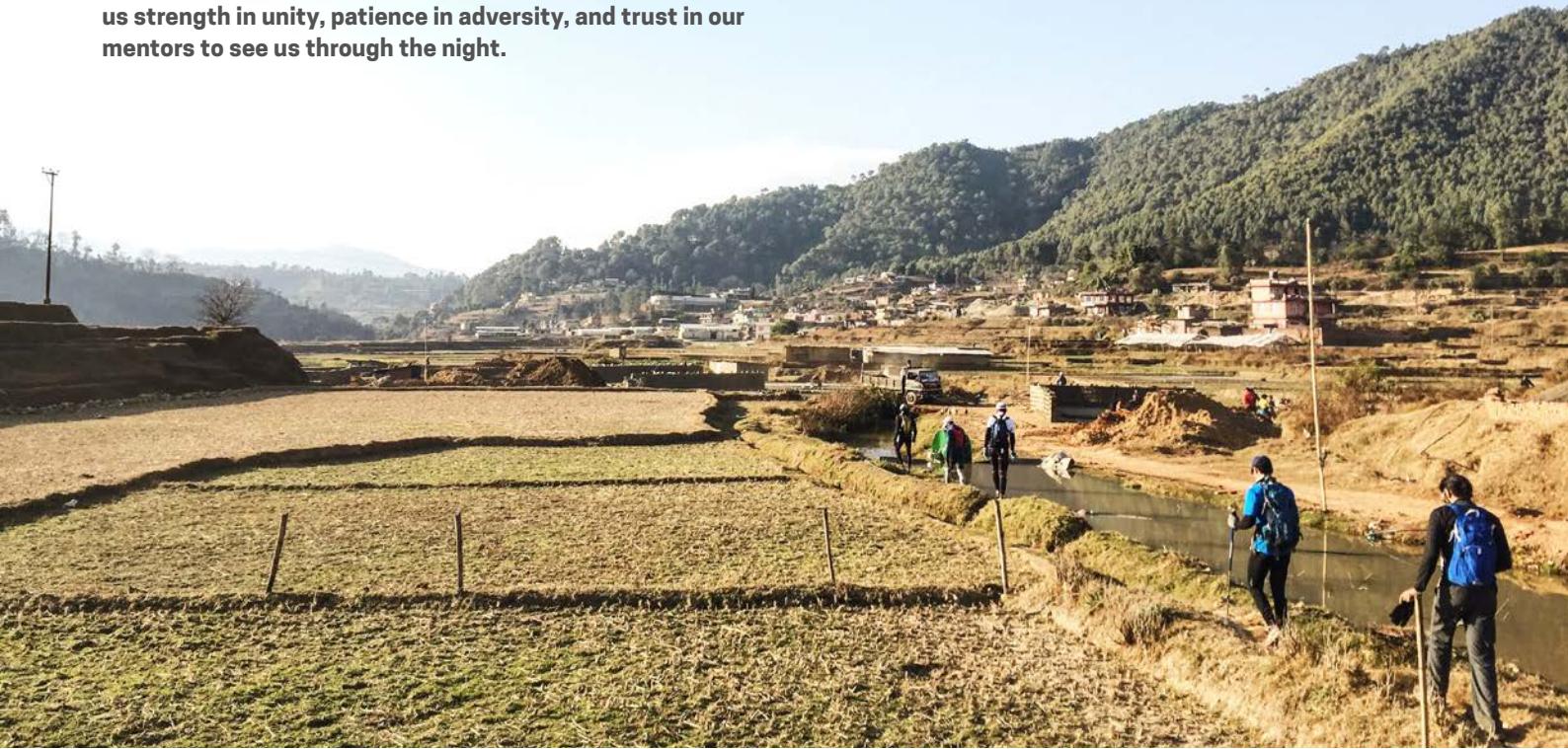
Taking over where their seniors left off, a fresh team of six medical students traveled to Kathmandu, Nepal late last year to run 200km of the Kathmandu Valley Rim in five days, the first team to complete such a trail. The team, Hargaven Singh Gill, Ho Jun Kiat, Huang Juncheng, Keith Ching Wei Jie, Navkaran Singh, Thaddeus Tan Jun Kiat, share their experiences during this unforgettable trip.



The Himalayan backdrop (and upcoming starry night) that accompanied our first night. The beauty and serenity of the region made it one of our favourite nights.

DOSSIER

From the highest point of the Kathmandu Rim at “Phulchowki” to the lowest point in the farmlands of Kathmandu Valley, it has been a long day for the team. Little did we know it would be our longest night, lost, with headlamps strapped to our chest and heads, navigating the unknown. That night taught us strength in unity, patience in adversity, and trust in our mentors to see us through the night.



PREPARATION

With a tight timeline of four months, our team worked hard to train for the Kathmandu Valley Rim, while managing the administrative tasks of our project and juggling school work. Our key events building up to our race comprised the Newton 32km challenge, the North Face 100km race and the StanChart 42km marathon. We carried backpacks weighing 5-8kg during the races to prepare us for the trail in Kathmandu, where we would be carrying our own gear, water and food supplies.

We had set a goal of raising \$25,000 for the SAMH's YouthReach division. We strived to meet this goal by reaching out to friends, corporate organisations, charity events and publicity platforms.

The toughest part of the trip preparation was acquiring equipment and sponsorships. We went knocking on the doors of many companies with our team manifestos in hand, and although we were turned down many times, the team was not dismayed because we knew the struggles we were facing paled in comparison to those faced by people with mental illnesses.

We were fortunate to have the guidance of our mentor, Associate Professor Tay Sook Muay, from Singapore General Hospital's Department of Anesthesiology. Her department and institution provided funds to cover part

of the operational and race costs. We were also fortunate to have been guided by Singapore's top marathoner and NUS alumnus, Dr Mok Ying Ren, and another inspiring individual, Dr Kumaran S/O Rasappan (who summited Mount Everest). Both shared their expertise on running and managing Nepal's terrain respectively. While our project was not under the purview of NUS, our Dean's Office offered helpful advice on safety and planning. We also had the good fortune of having supportive friends who trained with us, actively disseminated our outreach efforts, and donated to our cause both monetarily and with their time.

THE RUN

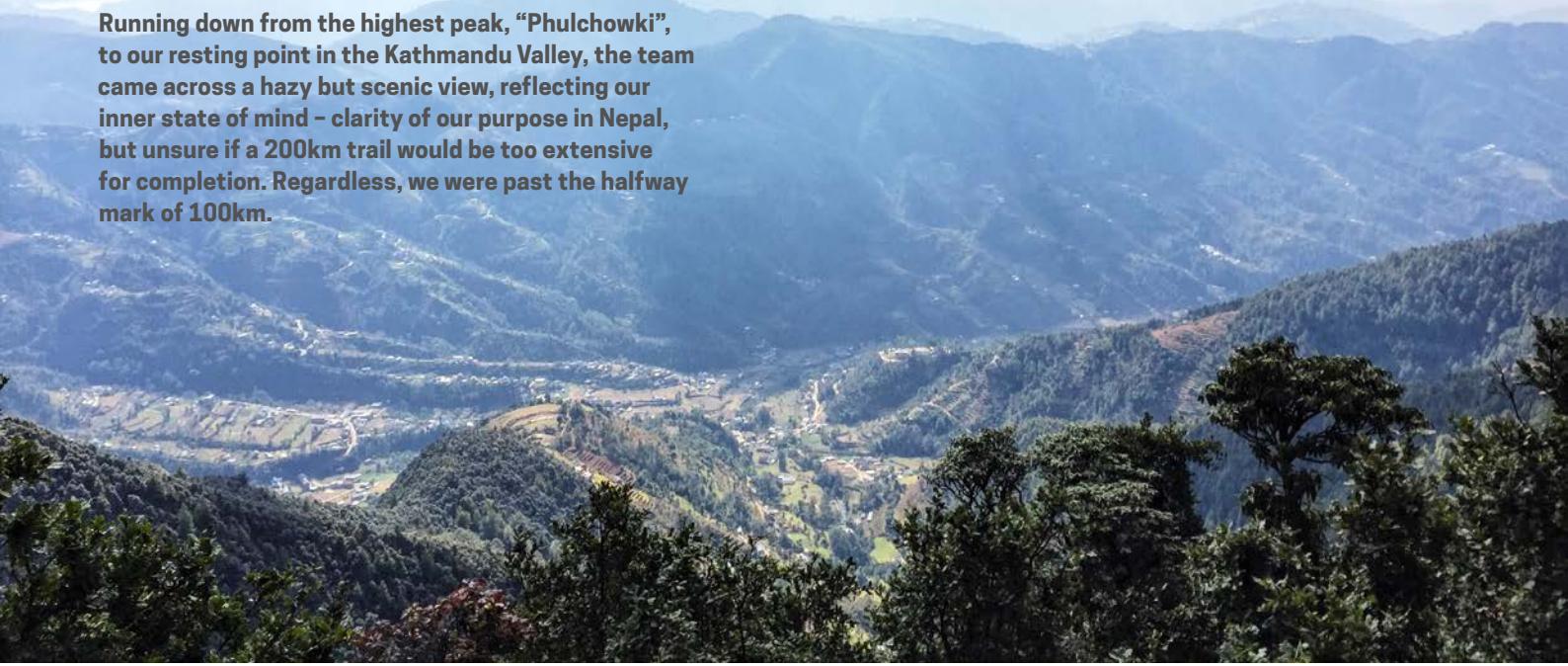
Upon arrival at Tribhuvan International Airport, we took a 30-minute drive to our accommodation in the heart of Thamel – heart of the tourism industry in Kathmandu. It was bittersweet knowing that within 24 hours, we would be leaving this hotspot, though we were encouraged by the thought that we would be returning to it for a well-deserved rest after our five-day odyssey.

Raj and Narayan, the two Nepalese ultramarathoners who were our leads on the run, met us for dinner on the first evening and we were swept away by their stories: Raj completed a 1,076km marathon in 17 days and Narayan accidentally came in second in a marathon in the UK. Physical limits clearly did not apply to them.

"THERE IS MAGIC IN THESE MOUNTAINS."

-RAJ

Running down from the highest peak, "Phulchowki", to our resting point in the Kathmandu Valley, the team came across a hazy but scenic view, reflecting our inner state of mind – clarity of our purpose in Nepal, but unsure if a 200km trail would be too extensive for completion. Regardless, we were past the halfway mark of 100km.



The trail run started at 7.15am on day 2 of arrival and we immediately understood what Nepal's top ultramarathoners are capable of – within minutes we had lost sight of our running leads. After slowing down to our pace and despite running 200km, they did not break a sweat nor sustain any form of injury at the end of it all. No amount of training could have fully prepared us for the unpredictable terrain, or the frequent elevation changes from 1,300m to 2,200m, and then to 2,600m. There was a mix of gravel, sand, mud, vegetation and roads amidst upslopes and downslopes (what we considered upslopes were downslopes to our two accompanying runners).

There were nights our team got lost, but those were also the nights that were filled with laughter and camaraderie, because we knew that we were a team fighting for the same cause. Our favorite moments on the run were when the team ran on the ridge lines, and got lost walking in circles on the third night. On both occasions, we did not know the destination nor how long more the trail would last. However, when we gave up the need for certainty and trusted in those shepherding the team, we learnt to live fully in the present, in the company of those around us, and that was all that mattered.

"There is magic in these mountains," Raj would say, and he was quite right.

Running on the ridge lines, away from the city and buzz, provided a quiet respite for our minds to distil our thoughts and reminisce as 2016 drew to a close. Being at the highest points of Kathmandu allowed us

to transcend our personal limits and worries, to acquire new perspectives for the year ahead.

OUTREACH AND OUTCOMES

Is this the end of our journey? Certainly not. We have merely begun yet another chapter of our lives. Completing this adventure was just the spark that ignited a passion for trail running, for we have learnt much more about what the sport really is. It is, and will always be, an enlightening experience to watch the grace with which trail runners propel themselves onward, despite the fatigue. And that is what life is about – moving forward with courage and tenacity whilst leaving a trail for others to follow.

After successfully completing the Kathmandu Valley Rim, covering 200km in five days, we were thankful to be home in time for Christmas – and the upcoming fourth-year Professional Examination. Thereafter, we will be focusing on outreach efforts to junior colleges – giving talks or conducting workshops on mental health awareness and resilience.

We have surpassed our goal of raising \$25,000 for the SAMH, but we will continue to give our best to represent a meaningful cause.

We invite you to join us in our fight against the ignorance that leads to stigmatisation of people with mental health difficulties.

For more information on Mental Muscle, please go to mentalmuscle.org or follow us on Facebook: [fb.com/mentalmuscle](https://www.facebook.com/mentalmuscle).



The PHS representative getting responses from the students in an interactive YHAP assembly talk on cancer at Crescent Girls' School in October 2016.

GETTING THE YOUNG TO TEACH THEIR ELDERS ABOUT HEALTH

By Sarah Tham, MBBS Phase II,
Russell Ang, MBBS Phase II &
David Yuen, MBBS Phase II

“Promoting Health, Spreading Awareness” – this is the motto of the Public Health Service (PHS), a preventive medicine initiative by NUS Yong Loo Lin School of Medicine students. PHS brought this motto a step further when it pioneered the Young Health Ambassadors Programme (YHAP) in 2015, as an extension of its initiatives into primary prevention. This was established in the light of shifts in the greater public health sphere towards increased community health screening and secondary prevention, giving rise to a prominent primary prevention gap that PHS sought to fill through health education.

The programme employs two main methods to achieve its aims – health talks and health projects. Both draw upon and tap on the influence and persuasive power which school children wield over their parents and other adults at home.

The programme cultivates and empowers youths to become Health Ambassadors who influence their families, schools and communities to adopt positive health behaviour. In particular, it encourages youths to influence their parents, as they comprise the middle-aged group that is at increased risk of several chronic diseases and cancers. While it may seem incongruous at first that PHS uses an indirect method to reach this target group, the approach is rooted in research findings that children have more influence over their parents' health behaviour compared to health professionals.

The outreach to school children begins with PHS committee members giving assembly talks at various secondary schools and junior colleges. Our speakers present important health information at an understandable level, and in an interesting, captivating manner. We started in 2015 with Anglo-Chinese School (Independent) and expanded to Chua Chu Kang Secondary School and Crescent Girls' School in 2016. Using images, videos, analogies and anecdotes, the talks emphasise the importance of the health topics and encourage the children to carry key health messages to their loved ones at home.

For instance, in our first talk on diet and exercise, we explained metabolic syndrome, diabetes, gout and hypertension in easy-to-understand ways, and emphasised that these are chronic diseases that people have to live with



Talk on cancer at Anglo-Chinese School (Independent) on October 2016.

for life. We then explained the practical lifestyle changes people could make to prevent the onset of such diseases, such as contextualising Health Promotion Board's My Healthy Plate to Singapore's hawker fare. For example, we explained how removing the skin of chicken meat meant a reduction of as much as half of the amount of fat present in chicken rice.

In another talk on cancer, we shared about some of the most common cancers in Singapore, as well as cancers that can be screened for – namely colorectal, breast, cervical and lung - emphasising the importance of early detection through screening, and lifestyle changes that people could make to reduce their risk of getting those cancers.

At every of these school talks, we underlined how important it was that the children shared what they learnt with their families and friends.

While chronic diseases and cancers are not typical topics of conversation for the young, we urged the students to spread the health message to those they love.

We received good feedback at all the schools we visited. Pre and post-talk surveys that we ran indicated students understood what had been shared with them.

As second-year medical students who had just learnt about

metabolic diseases and cancer, we found it a challenging yet enjoyable experience to share our knowledge at an appropriate level with younger people. Those of us who went back to our alma maters to present these talks found the experience enriching and nostalgic. The fact that we are also young people allowed us to better communicate with the students we spoke to, as peers rather than "healthcare professionals".

Here is the view of Dominic Ting, who spoke at his alma mater, Anglo-Chinese School (International) (ACSI) on Diet and Exercise in 2015:

"The idea of going back to ACSI to speak was never far-removed since I graduated in 2013. Having been greatly blessed by my education in ACSI, it was a privilege to return to the school to share with my juniors what I have learnt through my experience in PHS, and about the values we uphold. My committee and I believe strongly in public education, and empowering young people to make sound health decisions for themselves. We hope that through our talks, the students have gained greater insight into cancer prevention, and the different modalities of screening."

The second arm of YHAP involves mentoring a group of students on a health topic over a few months, culminating in a public exhibition by these students at PHS' annual health screening. In 2016, we worked with 25 Year 1

WHAT IS CANCER?

A **disease** caused by **uncontrolled cell division** of **abnormal cells** in the body.

CANCER CAN METASTASISE

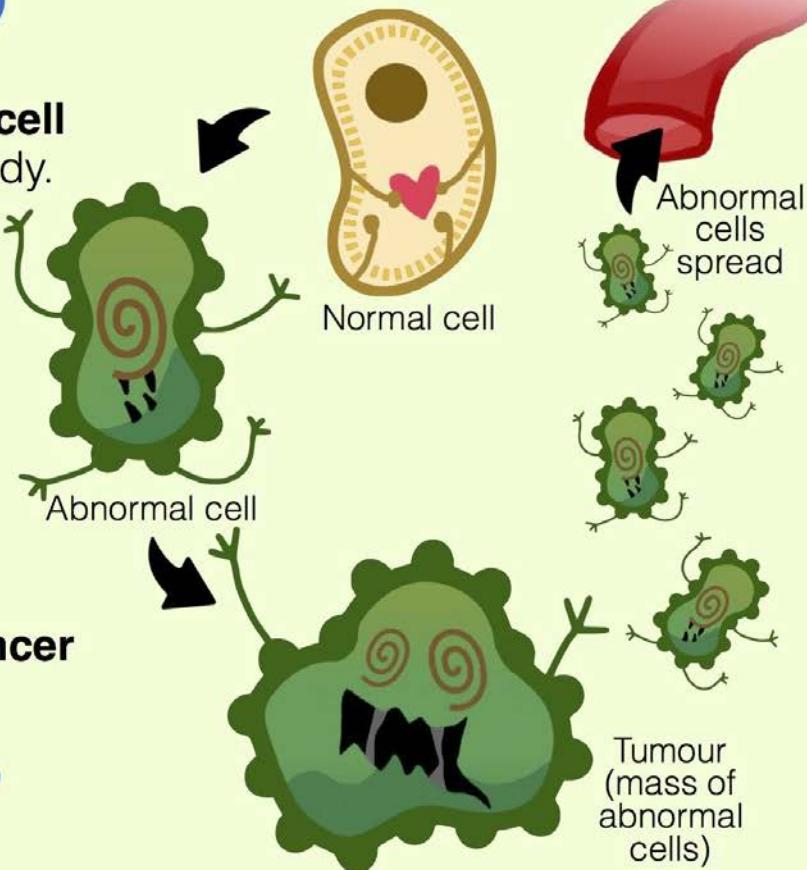
This means they can **spread to other parts of your body**, making it difficult to treat.

CANCER IS DEADLY

1/3 Singaporeans **get cancer**

1/2 of these Singaporeans **die of cancer**

BUT CANCER CAN BE CURED... IF DETECTED EARLY



students from Hwa Chong Junior College on the topic of cancer. The students were grouped into four teams, each in charge of researching a particular cancer. Over three months, with the guidance of the National University Cancer Institute, Singapore (NCIS) and PHS, they crafted exhibition posters and games that were put up on screening day, providing useful health education about cancer to the public. Well-rehearsed and equipped with knowledge of their topics, the students put up a very praiseworthy exhibition.

Below are some of the feedback given by the Hwa Chong Junior College students regarding their mentorship experience:

Moving forward into 2017, we plan to expand the YHAP efforts, to reach out to even more schools. We also intend to further our partnership with schools to craft a programme with greater sustainability and impact for their community. In the light of expansion in health education efforts, we also hope to recruit other volunteers from the healthcare community, to conduct health talks.

If you would like to find out more about PHS or the YHAP, visit our website at www.publichealthservice.org. If you are interested to help, or have any queries or suggestions, email us at medsocphs@gmail.com.

WHAT DID YOU TAKE AWAY FROM THE PROGRAMME?

“Getting the facts right is one thing, but the real challenge lies in convincing people to listen to you and consider regular screening for cancer.”

“Learned a lot more about cancer, and how to prevent it. Also the importance of living a healthy lifestyle and going for regular screenings such that the cancer is detected early with a greater survival rate.”

“Information about cancer and prevention methods which can be shared with relatives and friends. Memories from sharing the information through the booths with strangers and debunking their misunderstandings of cancer.”



FAMILY MEDICINE CELEBRATES THREE DECADES OF SERVICE

Prof Goh Lee Gan (far right) leading the toast to commemorate 30 years of Academic Family Medicine in Singapore.

Undergraduate training in Family Medicine began in Singapore in 1971 as a one-week posting to a general practice clinic. It also included 10 lectures on "Introduction to General Practice", organised voluntarily by the College of General Practitioners, Singapore. Thirty years on, the discipline is now a well-established undergraduate programme, as well as a postgraduate curriculum and Masters of Medicine (Family Medicine) examination.

NUS Medicine's Division of Family Medicine commemorated 30 years of Academic Family Medicine with a celebratory 30th anniversary dinner on February 25, 2017, at Orchard Hotel. The early pioneers of the Family Medicine programme, practising family physicians, alumni, students and partners of the Family Medicine division had a night of fun mingling over food and wine. The Guest-of-Honour, Mr Chan Heng Kee, Permanent Secretary at the Ministry of Health, also graced the occasion.



(Top) Guest-of-Honour Mr Chan Heng Kee, Permanent Secretary at the Ministry of Health, giving a speech at the celebratory dinner.

(Bottom) Guests of the Division of Family Medicine at dinner.





ADVANCES IN PAEDIATRIC ONCOLOGY

The 11th St. Jude-VIVA Forum in Paediatric Oncology

By Ms Cher Boon Meng,
Clinician-Scientist Unit, NUHS

Professor Thomas Lehrnbecher, from Johann Wolfgang Goethe-University in Germany, speaking about invasive fungal infections during chemotherapy and how to treat them.

Photo: VIVA Foundation for Children with Cancer

The annual St. Jude-VIVA Forum (SJVF) is a collaboration between St. Jude Children's Research Hospital (St. Jude) in Memphis, Tennessee, USA, and the Singapore-based charity VIVA Foundation for Children with Cancer. It is the leading regional conference in paediatric oncology which aims to share knowledge and foster collaboration among paediatric oncologists. Held on March 1 to 5, the 11th SJVF welcomed 240 delegates from around the world.

This year's SJVF brought news of improved treatments in a variety of paediatric cancers. The first day focused on leukaemias and lymphomas. Dr Tanja Gruber from St. Jude updated delegates on an improved protocol for treatment of infant leukaemia, a disease with notoriously dismal outcomes. Professor Wing Leung from Miltenyi Biotec in the United States then shared some of the ways that clinicians can improve the results of bone marrow transplantation by selecting for specific immune cell types and omitting others. Professor Dario Campana from the Department of Paediatrics at NUS held the stage with updates on cellular therapy, giving examples of trials conducted here at the National University Cancer Institute, Singapore.

Day 2 was dedicated to solid tumours and it also featured news of huge improvements in solid cancer treatments. We journeyed 20 years with Professor Alice Yu from the University of California in San Diego, USA, and Chang Gung Memorial Hospital, Taiwan, from the development of the antibody treatment ch14.18 through pre-clinical studies, and finally to its approval as Unituxin in 2015 for high-risk neuroblastoma. Dr Amar Gajjar from St. Jude introduced new therapeutic targets in brain cancers and Professor Carlos Rodríguez-Galindo from St. Jude wrapped

up the event with information about improved treatment protocols for germ cell tumours.

The SJVF aims to address the disparity in cancer treatment between developed and developing nations. Thus, the Pre-Forum Workshop was instituted in the second year. A mainstay since then, it is a chance for doctors to come together to discuss and solve issues that developing Asian nations face. This year, Dr Krista Lea Francisco from the Department of Paediatrics at NUS introduced the Paediatric Early Warning Score (PEWS) used at NUH to aid in early detection of clinically deteriorating patients. PEWS serves as a common language in the medical team, and empowers nurses to notify doctors of early signs of deterioration before critical deterioration occurs. Its implementation in NUH led to a 50% decrease in admission to the paediatric intensive care unit. This lecture spawned a very lively discussion among the participants, as it was a simple yet powerful way of improving patient care even in resource-constrained countries.

On the second day of the Pre-Forum Workshop, the participants heard from Dr Ratha Mlis of Cambodia. A young paediatric oncologist, she returned from training in France only to be told by paediatric hospitals in Cambodia that "now is not the time to treat cancers". Undeterred, she went to adult oncology hospitals and found a home at Calmette Hospital, where she set up a small paediatric oncology unit in 2014. Dr Mlis' sharing triggered a heart-warming outpouring of encouragement, advice and tips from doctors of other developing countries. The workshop concluded with the formation of several cross-border collaborative groups, each for a different cancer type.

DOSSIER



The South-east Asia Retinoblastoma Symposium 2017, held at NUS' Centre for Translational Medicine, was attended by paediatric oncologists, pathologists, and ophthalmologists from Singapore, South-east Asia, and the United States. Photo: VIVA Foundation for Children with Cancer

From the Pre-Forum, we were reminded that the success of cancer treatment depends on much more than mere therapy. In developing countries, socioeconomic and cultural factors greatly hinder treatment. Upfront treatment refusal or abandonment are also common problems: parents are unable to afford chemotherapy, or have difficulties accessing hospitals. For retinoblastoma especially, successful treatment usually requires enucleation (removal of the eyeball), and parents are understandably opposed to that. Even among clinicians, there is a dire lack of knowledge regarding cancer in children, with some not knowing that childhood cancers exist, or that it can be treated. This leads to delayed diagnosis and treatment, compromising cure.

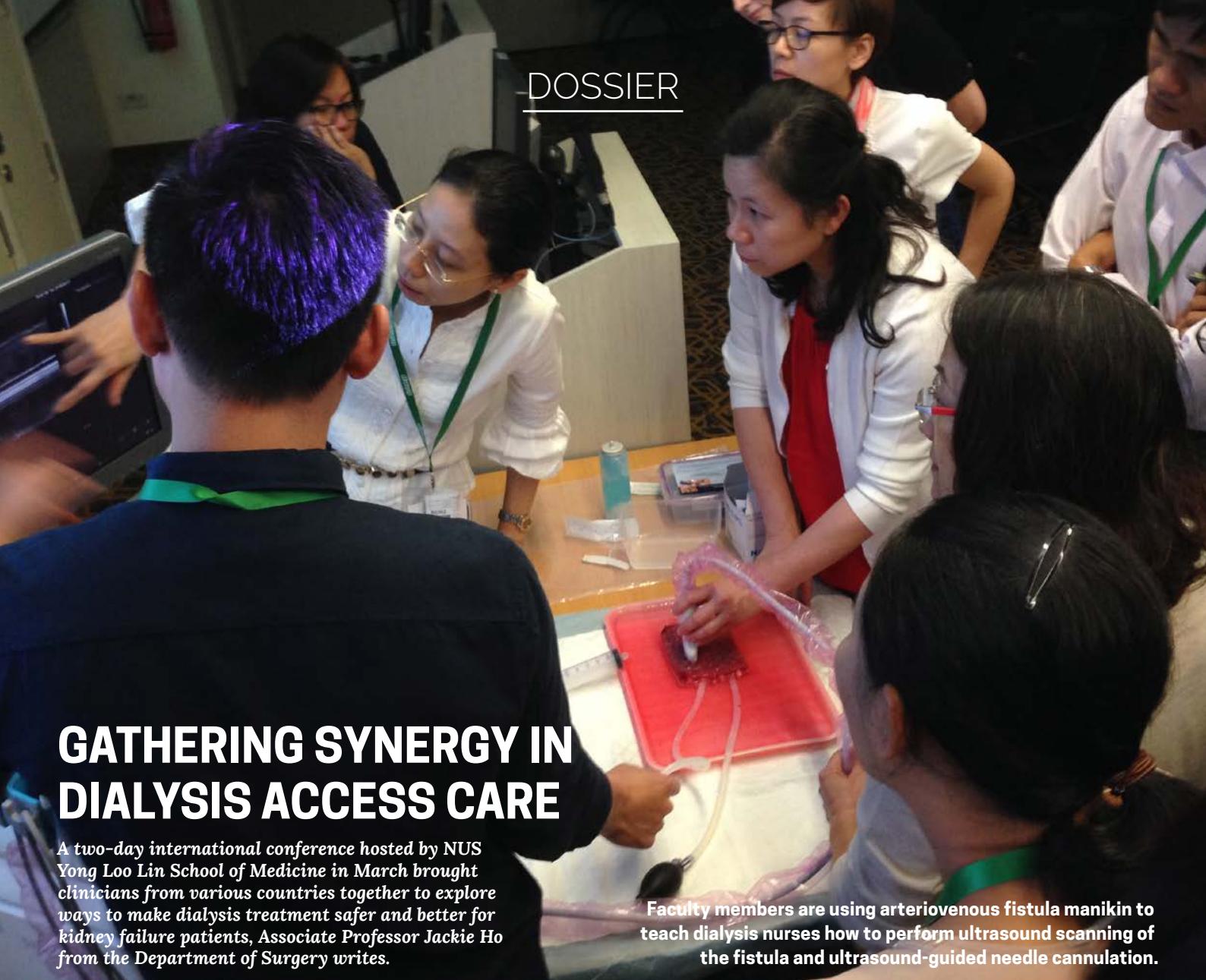
In addition to the Pre-Forum, the SJVF also gave rise to several collaborative groups: the VIVA-Asia Working Group, focusing on leukaemia; the VIVA-Asia BMT Group, focusing on stem cell transplantation, and the VIVA-Asia BST Group, which looks at brain and solid tumours. At the forum, each working group held closed meetings for deeper discussions in their respective areas. Since 2015, we have also held the Nursing Symposium and CCF-VIVA Family Learning Exchange, the former for nurses to share experiences and techniques in supportive care, and the latter for families of our patients to meet with experts and other families. This year also saw the inaugural session of the South-east Asia Retinoblastoma Symposium, which will be another mainstay of the SJVF.

There is an increasing need for paediatric oncologists to don several hats, what Professor Mathew Wilson from St. Jude

summarised as a “paediatric-ophtho-onco-radio-patho-logist”. Thus, the 11th SJVF invited clinicians from non-oncology specialties to share their expertise in problems that crop up during cancer treatment. As part of the Pre-Forum Workshop, Professor Paul Anantharajah Tambyah, from the Department of Medicine at NUS, gave a talk on tuberculosis (endemic in Asia) and how it complicates cancer treatment. Dr Wang Shi from the Department of Pathology at NUS, shared with participants some of the pitfalls in diagnosing lymphoma.

The South-east Asia Retinoblastoma Symposium also heard from several NUH clinicians: Dr Choong Chih Ching from the Department of Diagnostic Imaging on imaging of retinoblastomas, Dr Gangadhara Sundar from the Department of Ophthalmology on enucleation, and Associate Professor Nga Min En from the Department of Pathology on retinoblastoma pathology. The 11th SJVF ended on an optimistic note, with repeats of improved treatment protocols and higher remission rates across many types of cancers.

The foundation has come a long way since 2005, when Mrs Jennifer Yeo from VIVA Foundation, Professor Pui Ching-Hon from St. Jude, and Associate Professor Allen Yeoh from the Department of Paediatrics at NUS conceived it with the aim of improving childhood cancer treatment in Asia. Through the efforts of paediatric oncologists around the world, and the kindness of donors, the SJVF has achieved this aim over the last decade. It will continue to do so, and perhaps the day will come, when Prof Pui's vision of a “100% cure” becomes reality.



GATHERING SYNERGY IN DIALYSIS ACCESS CARE

A two-day international conference hosted by NUS Yong Loo Lin School of Medicine in March brought clinicians from various countries together to explore ways to make dialysis treatment safer and better for kidney failure patients, Associate Professor Jackie Ho from the Department of Surgery writes.

Faculty members are using arteriovenous fistula manikin to teach dialysis nurses how to perform ultrasound scanning of the fistula and ultrasound-guided needle cannulation.

End stage renal failure (ESRF) is a dreadful disease. An estimated 3.2 million patients worldwide suffer from this condition. In the International Comparisons chapter of the 2016 US Renal Data System annual report, six of the top 10 countries with high ESRF incidence are from Asia, and Singapore took the 5th highest position. In particular, Singapore and Malaysia have the highest incidence of diabetes-induced ESRF among all countries in the registry. While a small percentage of lucky ones are able to receive a donated kidney and undergo a successful transplant, a vast majority of ESRF patients have to rely on renal replacement therapy (hemodialysis or peritoneal dialysis) to maintain their lives. Dialysis access is the "route" enabling ESRF patients to obtain renal replacement therapy. In other words, dialysis access has become the life-line of ESRF patients.

With adequate dialysis, ESRF patients can lead nearly normal lives. However, if the plan and care of dialysis access is not well managed, a myriad of problems may develop that pose direct health hazards to patients or affect their adequacy of dialysis. The quality of dialysis access care has a huge impact on patient survival, quality of life, and healthcare resources requirements.

Although dialysis access is so important, the awareness, attention, teaching and training, resources, service quality surveillance and research on the topic are often neglected and remain rather primitive. The quality of dialysis access care in various Asian countries is still much less than satisfactory. Making the problem worse is the complexity of dialysis access care, which involves specific medical knowledge, surgical and intervention skillsets, as well as nursing technique. Healthcare professionals of different disciplines and specialties managing dialysis access are often working on their own and lacking collaboration or communication. This results in fragmented care for the ESRF patients.

Many passionate and devoted clinicians in various Asian countries are aware of the situation and have started fighting their way to improve the quality of dialysis access care in their specific socio-economic and healthcare environments. A group of clinicians founded Dialysis Access Synergy (DASy), which held the first pan-Asian dialysis access-focused meeting at the NUS Yong Loo Lin School of Medicine on March 31 to April 1, 2017. The meeting was organised by the University Surgical Cluster

DOSSIER

at NUH. The aim was to induce synergy among dedicated Asian healthcare professionals of various disciplines and specialties who take care of ESRF patients, ultimately improving the service quality of dialysis access.

This very first Dialysis Access Synergy meeting saw synergy induced among various restructured hospitals in Singapore with local organising committee members coming from the Changi General Hospital, Khoo Teck Puat Hospital, Ng Teng Fong General Hospital, National University Hospital, Singapore General Hospital and Tan Tock Seng Hospital. Synergy was also induced among hospital healthcare professionals and community dialysis services, including the National Kidney Foundation, Fresenius Medical Care and other dialysis centres.

The meeting also led to the identification of synergy among different healthcare professionals, including dialysis nurses, nurse specialists, renal coordinators, intervention radiologists, nephrologists, vascular surgeons and urologists.

Participants came from 17 countries and regions (Australia, Bangladesh, China, Hong Kong, India, Indonesia, Japan, Nepal, Macau, Malaysia, Myanmar, Pakistan, Philippines, South Korea, Taiwan, Thailand and Vietnam). The participants also interacted with international experts from Australia, Germany and the United States.

To set the foundation for better dialysis access care, DASy focuses on multi-disciplinary collaboration and structural training, emphasising the three themes of "Knowledge, Decision and Skill". To this end, DASy adopted a very different format from most medical conferences, with the meeting consisting of theme-focused talks, debates, case discussions as well as practical sessions including live

procedure observations, hands-on ultrasound workshops, surgical skills master classes, simulator training sessions, focus forums on dialysis access evaluation, surgical & endovascular toolboxes and challenging case discussions. The goal was for delegates to take home something useful for their dialysis access practice after attending Dialysis Access Synergy.

Dialysis access care in many Asian countries is still in the dark ages. However, with the synergy induced by DASy, medical professionals' know-how and spirits can be uplifted to help ESRF patients. The dawn of dialysis access care has come. Although the path to optimal care is a long one, by bringing together dialysis access enthusiasts to build on a foundation of multi-disciplinary collaboration and structural training, this goal will be achieved more quickly.



(Above)

A sonographer teaching the participants about ultrasound assessment of the central veins at a training workshop.

(Left)

A faculty member teaching the participants how to perform ultrasound-guided central vein cannulation for dialysis catheter insertion.



Students at an MGC event – the Innovation Challenge – held in August 2016.

INTERDISCIPLINARY TEAMS, OUT-OF-THE-BOX SOLUTIONS

By Kee Xiang Lee Jamie,
MBBS Phase IV

The Medical Grand Challenge (MGC) is a student-led medical innovation programme. Together with students from other faculties, medical students identify unmet healthcare needs and explore creative and out-of-the-box solutions to address these issues.

This competition runs for a year, starting with a soft launch in August 2016 and culminating in a final judging cum showcase night in August 2017, when projects will be scored by a panel of judges for business strategy, creativity, design quality and healthcare impact. Winners will be awarded \$20,000 worth of cash prizes.

Based on the idea that all discoveries begin with a single question, the MGC intends to nurture a culture of curiosity in our undergraduates. We hope to encourage creativity and entrepreneurship and build a generation of healthcare professionals who not only seek to serve, but seek to improve. Given the immense value of multi-disciplinary work, the MGC also seeks to foster relationships between students from different faculties and backgrounds. The MGC organising team is itself an inter-faculty collaboration, involving students from the Medicine, Engineering, and Business faculties.

Working on a range of different topics, from helping to make dialysis safer to tackling the growing epidemics of diabetes and obesity, 25 groups have been short-listed and given seed grants of \$500. Groups will be showcasing their work on August 18, 2017 at the NUHS Tower Block Auditorium.

HUMAN WELL-BEING AND SECURITY IN 2030: THE CRITICAL ROLE OF INNOVATION

By Professor Tikki Pangestu

Programme Co-Chairman, Raffles Dialogue Singapore 2017

Visiting Professor, Lee Kuan Yew School of Public Policy, National University of Singapore

Former Director, Research Policy & Cooperation Department, World Health Organization

In an increasingly uncertain and unstable world, the Second Raffles Dialogue on Human Well-being and Security aims to be a unique, trans-disciplinary platform for dialogue and discussion on various dimensions of human well-being. These include health, technology, information, financing and the role of global institutions. Health problems continue to haunt us, including epidemics of infectious diseases, ageing populations and the health impacts of climate change. Technology remains a double-edged sword, with benefits often not accruing to those in greatest need. In the information sphere, arguments on the benefits and risks of 'big data' continue. Development aid to developing countries is at great risk due to radical political changes in the developed world, and more will be demanded from global institutions to provide the good governance needed to ensure equity and social justice for all.

The Dialogue is the second iteration of the Raffles Dialogue on Human Well-being and Security, the first of which was held in Singapore in 2015. The Dialogue has two overarching themes. First, that we need to be aware of the key megatrends of globalisation that will affect future human well-being: ageing populations, environmental degradation, increasing role of technology, growing inequality, urbanisation, and the gap that exists between the knowledge that we have and our ability to use it effectively. Second, we need a new paradigm and philosophy for living and for health which places people's well-being and social justice, rather than diseases and survival, at the centre of the value chain. This places a strong emphasis on the interdependence and interconnectedness of the risks we

face, and, in turn, requires strong collective action from every level of society to mitigate the risks.

The second Dialogue adds value to the first by focusing on the importance of innovation in mitigating and overcoming the risks that were identified in the first Dialogue. Accordingly, its overall theme of 'Human Well-being and Security in 2030: The Critical Role of Innovation' emphasises the central need for innovations and new ideas to deal with the diverse and numerous global challenges in the years leading up to 2030.

Global and Asian scholars and thought leaders will participate in a series of interactive discussions and dialogue with over 100 participants from many countries in the region (representing academia, policy makers, international organisations, civil society, young leaders and the private sector) to discuss the needed innovations and collectively identify a way forward for the future. Representing the diverse and varied dimensions of the Dialogue, confirmed speakers include Lord Nigel Crisp, Member of the House of Lords, UK, and Dame Sally Davies, the UK's Chief Medical Officer. They will be joined by key thought leaders from the Asian region for a frank exchange of views from different disciplinary and regional perspectives.

The Second Raffles Dialogue will be held on September 4 to 6, 2017, at the University Hall at NUS.

For more information, please go to rafflesdialogue.com.



Prof Bernard Leung (left), the Dean of NUS Business School, and Ms Belinda Tanoto.

SECOND GENERATION TANOTO CONTINUES PARENTS' LEGACY

Ms Belinda Tanoto strongly believes in spending a lot of time with stakeholders on the ground to discover the real issues, which can then help shape philanthropic strategy.

The youngest daughter of Mr Sukanto Tanoto and Mrs Tinah Bingei Tanoto serves as a Trustee on the Board of the Tanoto Foundation, the philanthropic arm of the Royal Golden Eagle (RGE) Group. Founded in 1981 by her parents, the Foundation has supported National University of Singapore (NUS), with gifts to scholarships, professorships and research.

The Business graduate is immensely passionate about her work in improving the access to and quality of education in less developed countries, and applies principles she has learnt to find solutions for the community.

"The team and I spend a lot of time with teachers, parents and school supervisors to get valuable feedback. We believe that innovation happens on the ground, not in the headquarters. In discussing the issues with the community and listening to their concerns, the Foundation is better able to pilot solutions that address real needs. For example, we expanded our teacher training programme to include principals when we discovered that school leadership was a critical component contributing to quality education," Ms Tanoto explains, acknowledging that partnerships are also crucial in ensuring that assistance rendered to communities in need is holistic and sustainable.

"In Singapore, we partner with NUS to achieve our objectives. We have supported outstanding students in pursuing medical education at the NUS Yong Loo Lin School of Medicine, for example. We see NUS as a valuable partner in philanthropy because education is a bedrock of society. Partnering with NUS – a global university rooted in Asia – is a good way for us to address society's most pressing challenges," says Ms Tanoto, who spent personal time here as a judge for the Crossing the Chasm Challenge 2016, a social enterprise student competition

held by the Asia Centre for Social Entrepreneurship and Philanthropy at the NUS Business School.

The Foundation also supports Tanoto scholars studying at NUS, who participate in Project Sukacita. Students have the opportunity to visit Kerinci, Indonesia, a town in which RGE business groups have operations, to carry out activities such as basic health checks and education campaigns in order to help the local community.

Medical student Jaron Koh shares, "I signed up for this outreach programme because this was something I have always wanted to do, conveying health and education to the less privileged communities. Tanoto Foundation gave me a helping hand when I needed it the most and I owe the Foundation a huge debt of gratitude I would never be able to repay. As such, I hope to cherish every moment and opportunity I have to pay it forward, and Project Sukacita was one such opportunity."

Ms Tanoto and her siblings were exposed to the Foundation's work early in their lives when they were brought to an orphanage to share their toys with the children there. Their parents wanted to instil in them the lesson that the more you have, the more you need to share. It is with this same spirit that the foundation was set up.

"Not many people know this, but my father started his philanthropic work when he was merely in his 30s. This is a testimony to how much he believes in giving back to society. In fact, Tanoto Foundation traces our early roots to the establishment of a kindergarten and elementary school by my father and my mother Tinah Bingei Tanoto in 1981 in rural Besitang, in the Sumatera Utara province of Indonesia. As their children, my siblings and I remain fully committed to continuing our parents' legacy," Ms Tanoto affirms.

The story was first published on February 27, 2017, on the NUS Giving website.

CHIMERIC ANTIGEN RECEPTOR T (CAR-T) CELL



CELLULAR IMMUNOTHERAPY: HARNESSING THE BODY'S DEFENSES AGAINST CANCER

By Dr Khor Ing Wei, Department of Medicine &
Ms Cher Boon Meng, Clinician-Scientist Unit, NUHS

CANCER CELL

After the CAR-T cells bind to the cancer cells, they release toxic substances to kill the cancer cells.

In this second installment of the Cancer Immunotherapy series, we delve into cellular immunotherapy, which involves harnessing the power of immune cells to attack cancer cells.

First, let's meet the lead characters: the natural killer (NK) cell and the T cell, which are two of the immune system's most effective killers. NK cells are part of the body's first line of defense, specialised in detecting intruders (foreign organisms or cells). Interestingly, they can differentiate between cancer cells and normal cells. However, NK cells are relatively short lived, surviving for about a week in the body. T cells, on the other hand, can multiply in large numbers and remain in the body for months or even years. When NK or T cells recognise cancer cells, they are triggered to release toxic substances that kill the cancer cells.

AGAINST BLOOD CANCERS

At present, cellular immunotherapy is mainly used in clinical trials. NK and T cells can be taken from a patient, expanded (multiplied), and infused back into the same patient. In other cases, NK or T cells are taken from a donor, expanded, and infused into a patient. This may require matching of cell proteins to prevent rejection of the donor cells. Donor NK cells have shown promising results in blood cancers such as acute myeloid leukaemia.^{1,2}

Another intensive area of research involves modifying special proteins on T cells called receptors such that the T cells now recognise and kill cancer cells effectively. Each type of modified T cell recognises a specific type of cancer. The modified cells, called chimeric antigen

receptor T (CAR-T) cells, are expanded to obtain the large numbers (ranging from tens of millions to hundreds of billions) generally needed for therapy. CAR-T cells have shown impressive results in patients with leukaemia and lymphoma. In three trials involving 65 patients with acute lymphocytic leukaemia, 70% to 90% of patients showed a complete response to the treatment.³⁻⁵

AS WELL AS SOLID TUMOURS

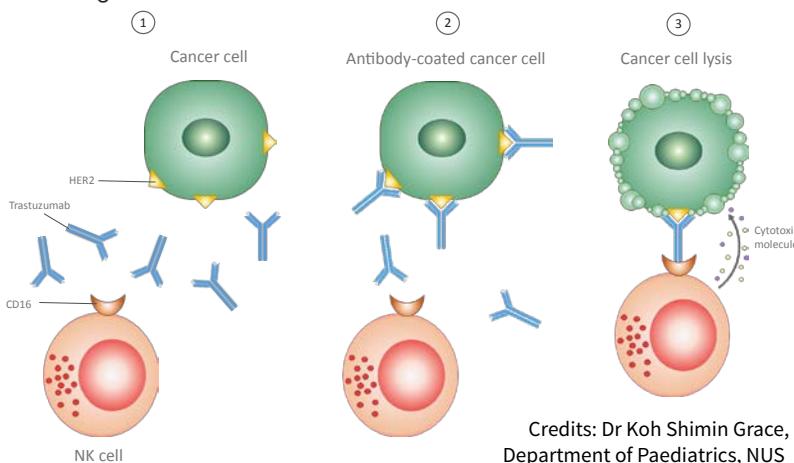
Besides leukaemia and lymphoma, researchers are beginning to test cellular immunotherapy as treatment for solid tumours such as melanoma as well as breast, colorectal, liver, head and neck, and non-small-cell lung cancers. At the National University Cancer Institute, Singapore (NCIS), Associate Professor Lee Soo Chin is studying the effect of activated NK cells and trastuzumab (Herceptin®), an antibody that acts against a protein called HER2, in 22 patients with metastatic HER2-positive breast cancer and gastric cancer.

Trastuzumab mainly works by blocking the proliferation of cancer cells that are triggered by HER2. The antibody also harnesses the patient's own NK cells to fight against the cancer, a process called antibody-dependent cell-mediated cytotoxicity or ADCC (see Figure). This mechanism is usually only a small part of trastuzumab's action because of the small numbers and weak activity of NK cells in most cancer patients.

However, in A/Prof Lee's study, each patient's NK cells are expanded an average of 300 times and activated in a

SCIENCE OF LIFE

Figure



1. Breast cancer cell expressing HER2 protein on its surface. An antibody targeting HER2, trastuzumab, is given to the patient.
2. Trastuzumab binds to HER2 on the cancer cell.
3. The NK cell binds to trastuzumab. Once bound, the NK cell releases cytotoxic molecules, which kill the cancer cell.

special culture in Professor Dario Campana's laboratory, then infused back into the same patient in combination with trastuzumab. In this way, the ADCC process is enhanced for better cancer control. Importantly, the NK cells from these patients with advanced cancer could be expanded to the same magnitude as cells from healthy volunteers. Also, the expanded cells are fully functional, showing high ability to kill cancer cells in the laboratory.

In the 11 patients who have received the treatment (trastuzumab and at least 10 million NK cells per kilogram of body weight), the disease stabilised in most of them, extending the time until their cancer worsened to more than eight months. This is encouraging as these patients had already been unsuccessfully treated with an average of six different types of therapy for metastatic cancer, including trastuzumab (one patient had tried 13 different treatments before this trial). Their cancers would almost certainly have progressed without effective treatment. The trial is ongoing and thus far, the therapy appears to be safe, with only relatively mild and transient side effects in two patients. Next, A/Prof Lee intends to test CAR-T cells, which are more effective killers than NK cells, in such patients.

Another NUS Medicine researcher, Dr Lim Chwee Ming from the Department of Otolaryngology, is evaluating the effectiveness of NK cells in head and neck cancers, which are especially prevalent in South and Southeast Asia.⁶ One type, nasopharyngeal cancer (NPC), is linked to infection from the Epstein-Barr virus. Dr Lim has started using activated NK cells and an antibody, cetuximab (Erbitux®), to treat patients with metastatic NPC and head and neck squamous cell carcinoma who have failed several other treatments. Similar to A/Prof Lee's observations, the NK cell therapy appears to be halting progression of tumours in the two patients who have been treated to date. As more

patients are treated, Dr Lim will evaluate this cell-antibody combination as a potential treatment avenue for NPC patients with very limited options.

A GAME CHANGER IN CANCER TREATMENT

Cellular immunotherapy has been revolutionary for blood cancers such as leukaemia and lymphoma, and shows promise against several types of solid tumours. As researchers test this therapy in more patients and in those with less advanced cancer, a clearer picture is beginning to form about this powerful weapon in the fight against cancer. Weighing the benefits on one hand, and cost and side effects on the other hand, will be an increasingly important consideration for clinicians.

Since many factors are at play in the tumour micro-environment, some cancers will probably need a multi-faceted approach. For example, different combinations of NK or T cell therapy, checkpoint inhibitors,* cancer gene inhibitors, and chemotherapy are being explored to find the best offensive line against various cancers.

*Antibodies that release cancer's chokehold on the immune system; see the first article in this series.

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Facts Box:

- NK cells carry a mix of inhibitory and activating receptors on cell surface
- At any time, net result of inhibitory and activating signals shifts balance to either "ignore" or "engage"
- NK cells use this balance to differentiate between normal cells and cancer cells
- Differs from T cell activation, which requires binding of specific ligands to T-cell receptor and co-receptor



DAILY CUPPA KEEPS DEMENTIA AT BAY

Regular consumption of tea reduces elderly persons' risk of cognitive decline by 50%, and potentially up to 86% for persons genetically at risk of Alzheimer's disease. The study by Assistant Professor Feng Lei and a team from NUS Medicine was published in the December 2016 issue of *The Journal of Nutrition, Health & Aging*.

Involving close to a thousand Chinese subjects aged 55 years or older, the study began with data gathering in 2003. The research team followed up with the participants every two years until 2010 to obtain further information on cognitive status, tea consumption, lifestyle, medical conditions, as well as physical and social activities.

Asst Prof Feng from NUS Psychological Medicine said that, while the study was conducted on Chinese elderly, the results could well apply to other races. "I believe the cognitive benefits of drinking tea should be the same across all ethnic groups because we share the same biology of ageing, the pathology of dementia is the same, and also because the bioactive compounds from tea are the same," he explained.

Effective pharmacological therapies and current prevention strategies for neurocognitive disorders are lacking despite high quality drug trials, shared Asst Prof Feng. "The data from our study suggests that a simple and inexpensive lifestyle measure such as daily tea drinking can reduce a person's risk of developing neurocognitive disorders in late life," he said.

Tea drinkers will be pleased to learn that the neuroprotective role of tea consumption is not limited to a specific type of tea. As long as the tea — whether black, green or oolong — is brewed from tea leaves, daily consumption of at least 200ml can help to reduce cognitive impairment. Asst Prof Feng said that the benefit of tea is due to the bioactive compounds present, including catechins, L-theanine, theaflavins and thearubigins.

"THE DATA FROM OUR STUDY SUGGESTS THAT A SIMPLE AND INEXPENSIVE LIFESTYLE MEASURE SUCH AS DAILY TEA DRINKING CAN REDUCE A PERSON'S RISK OF DEVELOPING NEUROCOGNITIVE DISORDERS IN LATE LIFE."

– ASST PROF FENG LEI

Asst Prof Feng and his team aim to embark on further research to better understand the effect of an Asian diet on cognitive health during ageing. One of the new studies, known as the Diet and Healthy Ageing (DaHA) study, will investigate the biomarkers of tea intake, where the team will collect blood and urine samples to measure participants' levels of catechins and L-theanine. The research team also plans to conduct an interventional study to determine the impact of drinking tea on brain function and biological ageing in people who previously did not drink tea.

This article was first published on March 16, 2017 in NUS News at news.nus.edu.sg/highlights/daily-cuppa-keeps-dementia-bay.



THE TAO OF THE CLINICIAN-SCIENTIST

Professor Chng Wee Joo, Director of the National University Cancer Institute, Singapore, recently won the 'Singapore Translational Research Investigator Award' at the 2017 National Medical Research Council (NMRC) Awards. In this article published last year, he shares about his journey to becoming a doctor-researcher. It is a long and winding road, a journey less travelled but one that is most fulfilling.

Very often the question is asked, "What is a clinician-scientist (CS)?" The definition is muddled. The NMRC will give you one definition; our own doctors will give you another. Is it embedded in the qualifications of the individual, type of research that he or she performs, or the practice that the individual is in? For example, Cancer Science Institute director Dan Tenen is medically qualified, he does a wide range of research (that is more basic and mechanistic) but is no longer a practicing clinician. I'm medically qualified, I do clinical translational research while also delving into the mechanistic basic components of this translational research, and I continue to practice clinically.

What is a true clinician-scientist then? I don't think there is a single definition. The way I look at it is this: what is the mindset of the person doing the research? Must he be medically qualified, so that he has

insight into the clinical problems and is able to then identify what matters most for the patient? Does he need to be a practicing clinician? It will help. But then again, if he is always thinking about how to improve gaps in clinical management, in improving understanding of disease biology so as to find solutions to help patients, I think that would suffice as well. And I think importantly, he or she should also be a very important and effective link between clinicians and basic scientists (BS).

THE JOURNEY MATTERS AS MUCH AS THE DESTINATION

Very often, collaboration between scientists and clinicians fails because they don't understand each other. The CS should be well-versed in the scientific methods and thinking processes required and act as the link (between clinicians and basic scientists). I don't just focus on the translational end

or clinical end of the research, because I know that a translational project may take many years to bear fruit. There are different phases to the work – from discovery to understanding of the mechanism, to identifying a treatment, to conducting clinical trials to get the treatment into the clinic eventually. In Singapore, we are often in a hurry. We want someone to come up with a KPI in three years. If that's the situation, you'd pretty much be forcing everyone to do work only to fulfill this objective. I think that is a waste because there are many unique diseases of the Asian phenotype that we need people in our region, in Singapore, in NUS to research. It can be a clinician-scientist and of course it can be a basic scientist as well, but we need to not forget about the entire process (that goes into translating research discoveries into clinical application).

I didn't have all these things in my mind when I started my journey. All journeys have a beginning and mine wasn't really very promising. I decided in secondary school and in JC that I really wanted to do medicine. I guess, many people then wanted to do medicine. It was a very popular degree to go

SCIENCE OF LIFE

for. I wanted to help people get better and I was interested in science and chemistry and so this provided a good mix. So I applied, as most Singaporeans do, to NUS Medicine. Most applicants don't get into NUS – and I was one of those. It wasn't a very promising start, but I always look at the silver lining and the light at the end of the tunnel. There's always a positive twist to something that appears disappointing at the beginning.

AT LEEDS

I ended up going to Leeds University medical school in the UK. At that point the only thing I knew about Leeds was the Leeds Football Club. I didn't know much about the medical school though I knew a few Singaporeans studying medicine there who had pretty good feedback on the school. It turns out that Leeds does have a very strong programme in haematology, a strong pathology department and the medical school made some early discoveries on surgical techniques and tools. And so, this became one of the first lessons that I learned – a CS must be able to take rejection as well as criticism in his/her stride, because you will face much hardship in your career. But it was at Leeds that the seeds were truly planted and I became interested in research and translational-type research. I realised going through medical school that many of the important advances in medicine and treatment were through key scientific discoveries. Some of them were quite amazing, e.g. the discovery of penicillin and some vaccines. I also realised that just learning what is in the textbooks will not make things better for the patient, because there are too many diseases that have poor treatment options and outcomes. We are just starting to understand and describe some of those.

THE AWAKENING

Indeed, there is plenty of research still to be done. In my last year at medical school I joined the radiology department on an elective to do research. This led to my first publication, the year I graduated, looking at prostate-specific antigen (PSA). It was not by intent but I was doing a project on cancer and the Gleason score in predicting the stage of newly diagnosed prostate cancer. The topic itself was not the main thing; it was the participation and getting my feet wet that I really liked. Some people will find the process very laborious and unexciting, but I find that the excitement

is in finding out something – in the joy of discovery. So I was developing an interest to do this kind of work. Then after graduation I went to another historic place, York, where I did two years on a general medicine rotation that was supposed to prepare me for the Membership of the Royal Colleges of Physicians of the United Kingdom (MRCP(UK)) exam. It was during this period that I encountered haematology. I wrote a case report when I was there and the combination of lab-based enquiry with clinical care connected particularly with my personal interest in diagnostics and problem-solving. So this was where my interest initially started.

After I finished my training as a Senior House Officer in the UK, I had to decide whether to stay and train as a specialist. I was already married then and the wife said, "Enough time overseas, better get home" because she had parents who were growing older. I came back. I interviewed with Endocrinology first because that was the one job that was advertised in the British Medical Journal (BMJ) and Endocrinology was one of my potential choices. But I really wanted to do haematology. The Singapore General Hospital didn't have a position at that time and the NUH was only starting its haematology traineeship and this wasn't advertised. A friend in the Ministry of Health connected me with the Head of Haem-Onc at that time, Lim Hong Liang. Hong Liang took me in for an interview with Liu Te Chih, who took a chance on me. So I joined NUH Haematology.

During that time, I had a colleague who was also interested in doing research studies and writing up case reports, and we encouraged each other on. I think environment is really important. At that time, I wrote up a case series on using cyclosporine to treat patients with renal failure who developed pure red blood cell aplasia due to erythropoietin (EPO) treatment. This was very topical at that time. The paper still remains highly referenced because people do use cyclosporine to treat this condition. I learned from my seniors at that time – Dr Liu and Dr Tan – that we truly ought to be observant and look at the clinical problem of our patients to obtain ideas and clues on what are the important things that we need to do for them, in terms of understanding what may help them.

THE PREPARATION

As a trainee in the wards, I published quite

regularly – small time publications like case reports and small studies. I was getting grants from the NMRC to do some small-scale research, so I was already ramping up towards a CS career path. But there wasn't a really clear career track for clinician-scientists in Singapore in the early 2000s. Most people ended up as clinicians. But as with most things in life, sometimes you will need to have a bit of luck and timing. At that time, Singapore needed more CSs and A*STAR was offering an international fellowship to overseas institutions for two years of funded research training.

The idea at that time was that they don't want to give you time for you to get a PhD – two years only; not three years, not four years. Because they want you to have enough training but not too much time away, so that you can come back straightaway to do your research in Singapore. So I was fortunate enough to get one of these and I went to the Mayo Clinic. Before I went, I actually had no idea how to do lab-based research, and that was the research that I wanted to do, because I realised that there were a lot of exciting things happening in the areas of genomics and genetics. This was the time when microarray technology and the genome project were emerging. I felt that it was an important frontier and I needed the skills for basic research to be effective at the Mayo Clinic, so I had to prepare in advance in order to hit the ground running.

I had understanding chiefs who allowed me to work at a research lab for three months. I am very thankful to Professor Ito and Associate Professor Motomi Osato, one of the senior scientists in Prof Ito's lab at that time. I spent three to four months with them learning how to use a pipette, how to do polymerase chain reaction (PCR), cloning, cell cultures, etc. Nothing came out of that experience in terms of publications, but it was very much an eye-opener.

Once, I sat in on one of their lab meetings. I could not believe how tough it is to truly be a good scientist. The postdoc who was giving a presentation was literally being picked apart for over-stating the interpretation of the data and Prof in his usual quiet but stern manner pointed out to him that what he said was incorrect. The difference is subtle. To my untrained mind at that time, I thought, "Wow, you mean this is



so important?" But I learned that in science, we have to be very precise, and this is one of the problems that many of our graduate students have. In their theses, they state all sorts of conclusions and claims which their data is not exactly saying.

THE COMMITMENT

I had an opportunity to go overseas at an early stage. Very often young doctors come up to me and tell me they want to do a PhD. I see it differently; I do agree that we want more MD-PhDs, but I believe we ought to be flexible and give advice based on what kind of research the person wants to do in the end. I am not convinced that it's always worthwhile to take the time to do a PhD if your work doesn't require that kind of training.

So it's the end in mind that is important. Those aspiring to do research on databases, analyse data or publish don't need a PhD. We have other opportunities such as the Master of Clinical Investigation (MCI) – shorter courses, more focused, targeted towards that area. I think if you do need to do work that is mechanistic and more scientific,

understanding of basic mechanisms and in the lab, then the discipline of doing a PhD may be useful. But again, what does the PhD study entail? The components of it are also important.

So if you ask me, on hindsight, I did do a PhD. Did I find it useful? If I had not done it, would my three years (one year at the Mayo Clinic) be enough for me to be where I am today? I would say yes. The most important component of that PhD were the three years of research discipline in the lab under good supervision. If I had not submitted a thesis and got a PhD, I wouldn't have acquired the skills I need for the work I do today.

Many international professors observe that our PhD programme doesn't focus on research; it focuses on coursework and finishing modules and attaining the required Cumulative Academic Points (CAP). You don't really have a lot of time doing research. So whether learning on the job is enough or you need the formal certification, what is the formal qualification/education required?

I did a PhD at that point. I thought, why waste the time? It's always useful to have a paper qualification in Singapore. I was lucky also to have the help of Associate Professor Evelyn Koay, at that time the Director of the Molecular Diagnosis Center (MDC), who was willing to take me on as a student. I did a part-time PhD. I did my research at the Mayo Clinic first before coming back to do my 1-year of courses or modules here as an Associate Consultant, running clinics and attending classes, taking exams etc. Prof Koay was very helpful and taught me that for scientific writing, you have to be quite meticulous. I was quite careless, and she would hand back the thesis to me with her comments in red ink.

A TURN IN THE ROAD

My journey had many twists. I wanted to go to the Mayo Clinic in Rochester, Minnesota to do myeloma research. Myeloma is a clinical entity that intrigues me. It's a very complex problem that has interesting diagnostic dilemmas. Patients present with all kinds of multifactorial problems. However, nobody in Singapore then was really into

SCIENCE OF LIFE

myeloma and this was an area of very active growth in terms of drug development. Through one of my seniors, I was connected to the Mayo Clinic and they accepted me. I was going to do genomics and myeloma with Professor Rafael Fonseca, who was emerging as a very important person in this field at that time.

I was expecting to go to Rochester and as I was preparing all my winter clothing, Rafael emailed me a month before my departure. "Sorry, we have a change in plans. I am now going to Arizona – Mayo Clinic still – because I've been asked to go there to head this new division of haematology and set up a genomics collaboration with a big genomics institute in Phoenix. Are you still coming?" I said yes, because I want to learn from him. I threw away all my winter clothes and bought shorts and t-shirts because I was now going to the sunny state where you see cactus and sand and mountains and there's hardly anything else. This was one major twist, but it turned out to be a great place because they were recruiting all these top scientists in myeloma and building a new institute and I got to be right in the middle of it all.

The second twist was that I was supposed to go there and learn about mutations in genes that control cell division. In myeloma there is a lot of abnormal DNA or chromosomal segregation. So the idea is, the genes that control mitosis are abnormal so that the separation of the chromosomes become abnormal. Within six weeks of getting to Mayo in Arizona, we did screening of these mutations using many patient samples and they were all negative. So it was back to the drawing board; it was not a programme that would work. Rafael quickly concluded that we should not waste time on this, and to start on a project with this genomic institute to look at microarray and gene expression in myeloma. One thing that the Mayo Clinic has a lot of is patient samples. So I went and learned different techniques to do microarray.

MAYO DAYS

I picked up different sets of techniques that were completely different from what I was initially intending to learn. They were very useful techniques to acquire and continue to help me throughout my research career, because these have become a core skill. Within the first year, I managed to complete one of these projects and submitted the manuscript to the journal, *Blood*. To a

Singaporean haematologist, *Blood* is the 'holy grail', the top haematology journal we read for the latest advancements, what we should do for our patients and so on. At the Mayo Clinic, *Blood* is the basic – you must do enough quality work to submit to *Blood* first. I submitted my work and thought, fat chance this will get in. Funnily enough, they came back with only minor revisions in the first round. So I thought, "Research is not that difficult!" I was lucky enough to get my first paper in *Blood*. This was the only time that it was that easy!

My two to three years at Mayo were spent working really hard. I was alone; my wife and children were back home. So all I did was research every day and I also read a lot. I was picking up a lot of new things, like gene expression. This is one thing which I find many of our younger postdocs and graduate students do not do, with many preferring the shorter route – their source of reference is Google or Wikipedia.

In their presentations, some refer to Wikipedia and that is not a good thing. You really need to read and understand. So sometimes when I tell them to work on a newer area of research, I ask if they've read the key papers in this area and what are the assays that investigators use to look at this pathway (for example) and they look at me, in expectation that I would provide the answer. No, you must go and read and find out and enquire and plan and come back to me with a plan which we will then discuss. So I think the willingness to put in the hard preparation work is often not there nowadays.

MENTORS MATTER

Another thing that is important is the choice of mentors. I went to the right place at the right time; I didn't just get Rafael – I got Keith (Stewart) and Leif (Bergsagel). These are fantastic scientists. Leif was the one who cloned all the mutations that we know of today in myeloma. He taught me more about scientific thinking. Rafael turned out to be a very good administrator-scientist, while Keith is very translational, seeing the clinical potential of many things. He is the director driving the precision medicine initiative for the entire Mayo Clinic and will be visiting us sometime later this year. So I didn't get just one, but three mentors.

Mentors are important and you need to choose them carefully. It is not always the

case that great scientists, very famous people, are good mentors. Not all leaders in their field make the best mentors. Neither do all senior people fit the bill. Instead, some of the junior and upcoming scientists are the ones who are very invested in people. For example, Rafael taught me that research is like an investment portfolio. You shouldn't place all your money on just one project. You should have your portfolio of low-risk, middle-risk and high-risk projects. The high-risk ones will get high impact publications but you are prepared to fail there because it's not always easy. The middle ones are the ones you get into *Blood* and so on and they are a bit harder but nonetheless do-able. Then the easy ones are maybe your impact factor five types, with a near certainty of getting published. And you want to make sure that you always have this so that at any one time, you're publishing something. So you don't have gaps in your publication history. I thought that's very sensible and that's essentially what I have done and still do.

ABOUT MENTORSHIP

And what is mentorship? They also taught me that it's not knowing everything under the sun, but knowing where to get the information. Mentors know how to facilitate things; they know how to guide you when you're unsure of how to do certain things, and they don't control exactly what you do. The micro-managing type of mentorship really doesn't work. Good mentors allow you creativity, freedom, they give you broad strokes – this is what they think conceptually you should think about. They offer you career advice.

When I was asked to be director of the National University Cancer Institute, Singapore, I went back to my mentors and asked, "What do you think?" I didn't just ask our own guys. I consulted my mentors because they've been through it, are directors of institutes and they know whether it's possible to continue to manage their research portfolio and all these things. So my mentors have become friends, which I think is a relationship that is worthy to establish and think about. We don't always have very good mentors available in Singapore because the pool is small, though it is growing. There is no better time than now to be a clinician-scientist, but you need to be aware of all these things and plan carefully.

SCIENCE OF LIFE

WHAT IT TAKES



Recently there was an NMRC Symposium and many like Goh Boon Cher, Khoo Chin Meng and Tai E Shyong shared their experiences as clinician-scientists. As I sat there listening, I thought, "This is quite amazing because all of them mentioned very similar things – the need to handle rejection well and possessing tenacity, amongst others – which highlights to me that there are some qualities that are innate to all good clinician-scientists. That brings me to this question that I ask myself: now that we have funding for clinician-scientists and we have a mandate that we need to train 80 by 2020; can we really do that? Can we turn someone into a clinician-scientist? They must be born with certain qualities. And I think that is an interesting conundrum. But I truly feel that you must have some passion and interest because it is a very harsh environment; a very tough journey; you take a longer time than your colleagues – you must really want it. If not then, even if we give you money to help you with the first few steps, you ain't going to continue on the rest of the journey because the money may run out. It's not going to always be there. You have to fight for the money eventually.

CULTURE AND ENVIRONMENT

A culture of research is very important. I was lucky to be in a department where there are clear role models. Boon Cher and many of us had understanding Heads who recognised even at that time, the importance of academic excellence and research. And I was given protected time as a junior faculty member and encouraged to do what I wanted to do. For Heads who want to build up departments with more clinician-scientists, some flexibility is very important. And of course, funding is important, though this should not be an issue in Singapore now.

RECRUIT AND BUILD THE POOL OF CLINICIAN-SCIENTISTS

Overall in the world, there is a fear that this group of people is diminishing. In America and Canada, part of this is due to poor funding. One important way to develop more clinician-scientists is to recruit the right people from medical school. The way we structure our interviews of students seeking admission to medical school here – do we consider the elements that will make good CSs or are we just recruiting pure clinician types? This is important to consider because whoever you recruit will determine the kind of output you will most likely get.

GETTING STARTED

Once I graduated, I had to shift my focus to how could I be successful when I came back to Singapore. I would no longer be in the cradle that is the Mayo Clinic, with all the resources that they have, and this is where planning and strategy is important. You need to play to your strengths. I asked myself these questions:

- WHAT IS YOUR STRENGTH?
- WHAT DO YOU NEED?
- WHAT IS AVAILABLE?
- WHAT IS IMPORTANT?

I did that thinking and realised that I would be in trouble if I wanted to do my own research alone. I have about 30 new cases of myeloma in NUH per year. They (Mayo Clinic) have a few hundred each year. There was no way I could compete with these guys. Even if I want to build up a bank or a prospective cohort, it will take some time. So I needed to look at other potentials. During my time at Mayo, I made trips back home, talked to people here and understood who the people doing research in haematology were and what they were interested in.

At that time we had a new pathologist, Ng Siok-Bian, who was interested in a rare type of lymphoma called NK/T cell lymphoma. She was collecting samples. I thought that this was useful for Singapore as it is common, a very deadly disease that we know nothing about and I have the skill (in microarray gene expression) with which I could interrogate this kind of disease. So I worked with Siok-Bian and within two to three years, we submitted a paper. The collaboration has continued and we have become one of the known centres in the world that is studying the biology of this disease. So, you need to be strategic; you need to know your needs, your strengths, who you can collaborate with, and start to form some collaborations. This is the part that will bridge my gap and build my research in myeloma, and it is something which will take time.

BUILD THE RESEARCH

Those who are interested in doing translational type research should build their infrastructure. You need your clinical database – you need this to be linked into a cell bank. If you need to do genomics, a bioinformatics framework or some ability to analyse that data is required. For those who want to do drug testing, you need to build the model, i.e. in vitro and in vivo drug

SCIENCE OF LIFE

testing platforms. Do you fulfil them all in one day? No. It takes time, but you need to start with the first two i.e. a clinical database and cell bank – they are the easiest and they are your 'currency', because they are the resources your basic scientist researcher will come to you for. And this is where you will get your initial collaboration.

Over the last few years since I built up those databases, we've had engagement from NUS, from industry, from A*STAR to academic institutes to run different drug screening programmes for them. It's produced more than 60 since 2009, just using these resources that we have built up.

BUILD THE TEAM

"IF YOU ONLY DO WHAT YOU CAN DO, YOU WILL NEVER BE BETTER THAN WHAT YOU ARE."

I picked up this quote when I went to watch Kung Fu Panda with my kids. It shows that you can learn from everywhere. I think this is a very profound statement. What it says is that we shouldn't limit ourselves to our own comfort zones.

This is how I view building my team:

Complementary expertise. It could be easy for a PI to employ only those who know less than the boss. In this way you will never be able to go beyond your own comfort zone and grow. In fact, if I know that the project requires a lot of protein-based knowledge that I don't really have, I get a good postdoc in that area to come and I build this team.

Keep good people and allow them to blossom. Some of my team have been with me for more than 10 years, getting long service awards. Tae Hoon, who is my bio-informatician, was working with me when I was in Arizona. When I came back to Singapore, he asked if I had a job for him – he wanted to be nearer to his home in South Korea. He's been working with me for more than 10 years. The understanding we have is highly valuable.

BUILD THE PROGRAMME

Over time, we have pieced things together and have a clear idea of the research we want to do, the disease models that we want. It an integrative approach, not haphazard, not piecemeal. I know that if I want to make

a real impact on patients' lives, I also need to improve the clinical trials capability in haematology. I was in a department that already had a very nice group of clinical trial coordinators and setup, so I was fortunate to be able to tap into that. But it requires energy. Before I came back in 2008 or 2009, there was very little haematology research activity and Boon Cher will tell you that. Since then, we have built our recruitment so that over a period of six to seven years, we have five times the number of patients recruited. Last year, we were involved in a trial where we were one of the top recruiters in the world as a single centre here at the NUH for a global study in a disease like myeloma and which resulted in senior authorship in a paper that resulted in the approval of a drug. Again, small size doesn't mean you cannot succeed. With organisation, some energy and effort, you can also make an impact in the global setting.

BUILD THE NETWORK

It's also important to build your network because if you're alone, in this day and age, it is very hard to do good and impactful research. Collaboration is key. Sometimes I hear others say that it's hard to work with colleagues from other hospitals. Well, in haematology we have managed to set up a national consortium. Each party has ownership of different programmes that makes research very effective. Sometimes we also find it hard to collaborate with our friends in Hong Kong, Korea etc. – we view them as our competitors. But again, we have managed to set up an international consortium that has been very successful.

GIVING BACK

We need to contribute to our institutions at some point in our careers and there is no better way to do so, than to be in a position to change policy so that we help to make things better.

My plate is full these days and they keep me going, because if there is only one thing and that thing is not really working well, you will actually become very frustrated. But here sometimes I'm frustrated in some areas but in others, I'm getting joy. So overall, it keeps me going.

MAINTAIN WORK-LIFE BALANCE

The other important thing is family. Have some interests outside of work. Spend time with your family. My family gives me the

energy to do what I do: I am blessed to have an understanding wife. And because I have to be away from home sometimes, I am also thankful for the support of my staff.

A WORTHWHILE JOURNEY

Apart from some personal accolades, the important thing is to be a good CS, to make impact for our patients. Through the work, I have seen the survival rate of myeloma patients almost double since the time that I began working on myeloma.

We have managed to implement new models of care that actually help our patients, such as the outpatient transplant, which reduces the length of hospital stay for the patient. There is no increase in mortality or complications, but it saves the patient about 30% of the cost of the transplant. And it frees up hospital beds for other patients.

Through our clinical trials, we've also seen patients who have benefitted from access to new drugs. A patient of mine was dying of a disease that was at end-stage. He participated in a clinical trial, had another two years of good quality of life, saw his daughter graduate from Pharmacy studies and his older daughter get married. This is a meaningful outcome for patients.

I've managed to be involved with and form the Asian Myeloma Network. I have helped start clinical trials in Asia so that we can push the agenda for our Asian patients. This has helped to elevate our institution's international standing and drive some initiatives through the international myeloma working group, while also writing consensus statements. All these came about because I was able to stand on the shoulders of many giants. They have helped, supported, encouraged and nurtured me over these many years of my journey. That's why it's important for me to make it happen for my younger colleagues as well. Mentoring medical undergraduate and graduate students and our other doctors in the department and creating an environment and a legacy that can last for generations is what I want to do. It's important to ensure that we make it happen for others as well.



THE FUTURE OF MEDICINE

By Professor Hooi Shing Chuan, Department of Physiology, Dr Dujeepa Samarakkera, Centre for Medical Education & Dr Terry Pan, Department of Anaesthesia

Imagine, the year is 2050. It is 6.50am, a routine Monday morning. You are about to go to work after a sumptuous breakfast prepared by your new automated cooking robot - Moley ([hyperlink: http://www.moley.com](http://www.moley.com)). Suddenly the Organo-wrist (ORIST), a watch you have been wearing which monitors the organ systems, detects a sudden increase in heart rate and drop in blood pressure.

Within seconds, Dr Fam, your family doctor, appears before you in the form of a hologram. "Mr Pan, body sensors and house cameras have picked up an acute swelling of your eyes and wheezing in your breathing. It is likely that you are having an anaphylactic attack. Please stay calm. EMRRO will be there very soon."

Dr Fam's immediate "presence" and reassurance brings a much-appreciated calm to a tense situation. EMRRO (Emergency Response Robot) is the latest emergency treatment robot acquired by the city's healthcare system, which has moved most tertiary care from hospitals into patients' homes. EMRRO, touted for its reliable and precise care, arrives just as Dr Fam finishes his sentence. EMRRO delivers a new personalised anti-anaphylactic drug,

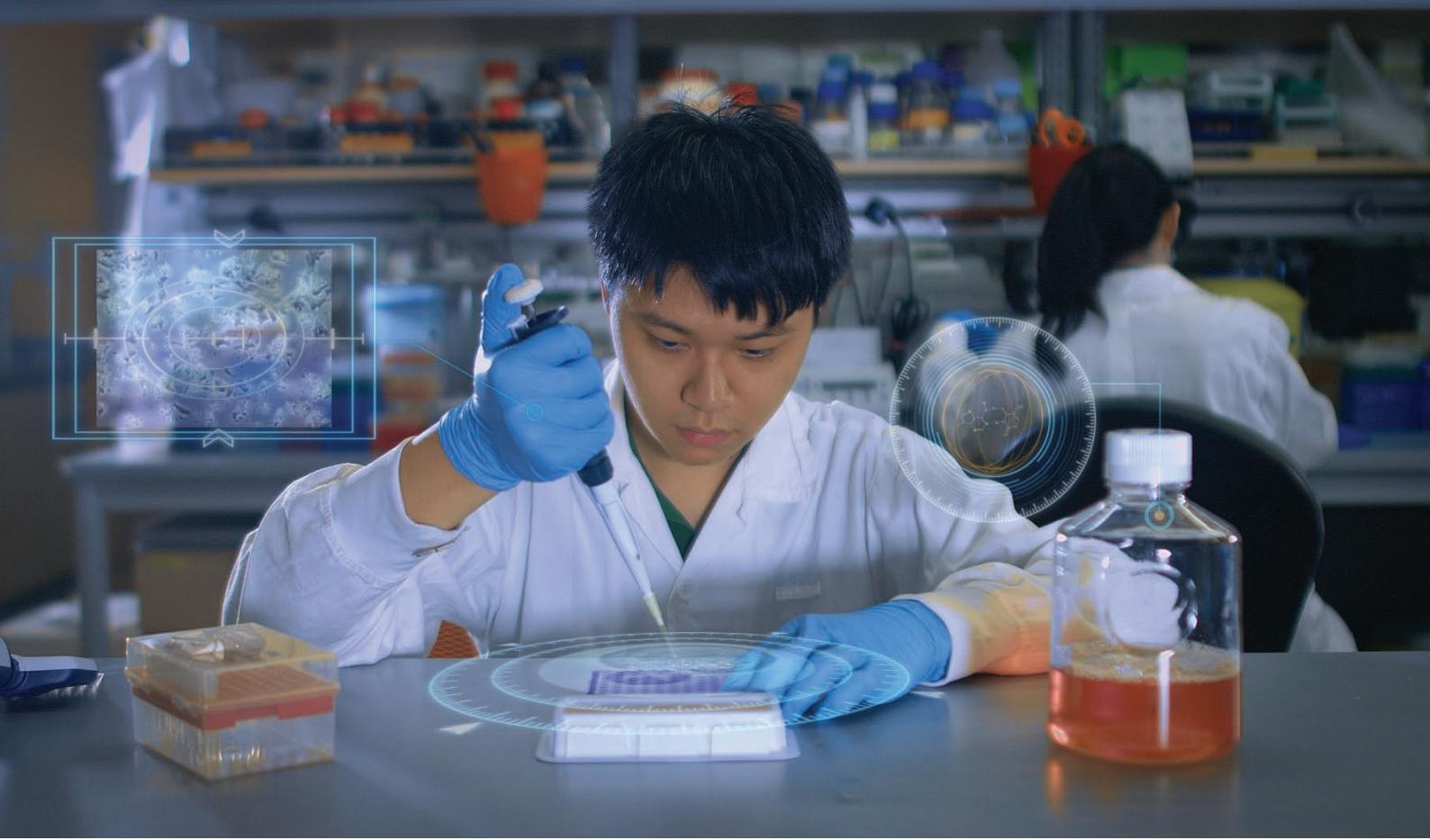
matched to your DNA profile, through a nasal spray, and brings your vitals back to normal levels within minutes. Throughout the treatment episode, EMRRO monitors your vital signs and patiently responds to all your questions.

All around the island, hundreds of medical emergencies are being monitored in real time by attending On-Call Physicians like Dr Fam. EMRROs are sent to homes to deliver appropriate care where necessary. Patients are remotely monitored and direct communication maintained with a medical professional throughout the care management.

As you recover, Dr Fam advises you to keep ORIST strapped on as your genetic testing had revealed increased propensity for atopy. You feel thankful that you had taken Dr Fam's advice.

COULD THIS BE THE FUTURE?

We live in an ever shrinking and increasingly interconnected world linked through technology. Advances in medicine, genetics, technology, robotics, big data analytics, machine / deep learning will radically transform



and disrupt the practice of medicine. What does the future hold? How do we think about the future? Richard Smith, writing in the British Medical Journal, posits: "Extrapolation of current trends is a poor way to think about the future, particularly at times of great change." We are in a time of great change. We cannot think about the future in small incremental steps, we leap into the future by our imagination. So let's imagine...

IMAGINE A FUTURE WHERE SUPERCOMPUTERS ARE BETTER DIAGNOSTICIANS THAN HUMANS

Already, cognitive computing, like the IBM Watson project, is training computers to learn and decipher unstructured data. Ever since it bested the two top trivia champions of Jeopardy! in 2011, Watson has been kept busy with the ins and outs of the healthcare industry. It is already providing insights into optimisation of possible cancer treatments to oncologists at the Memorial Sloan-Kettering Cancer Centre (MSKCC) in New York City. The real benefit of using cognitive computing like Watson is that it may be trained to help oncologists in the community who see a handful of patients a year achieve the "same level of expertise" as oncologists at MSKCC, who see thousands of such patients a year (Miller, 2013). Watson is also able to provide the latest research at a click of a button to anyone connected to it. In addition, with cognitive computing being able to decipher unstructured data such as natural speech, Watson, may actually "see patients as individuals and not

a number on a page" (Miller, 2013). In the face of such disruptive challenge, what then is the role of the human healthcare provider?

IMAGINE A WORLD OF PERSONALISED MEDICINE

The entire human genome can now be fully sequenced in a short period of time at relatively low cost. This cost will continue to go down as technology advances. In 2012, the national UK 100,000 Genome Project "created excitement and hope that by sequencing thousands of Britons, more clues about cancer and rare diseases would be identified" (Haga, 2017). Coupled with a deeper understanding of the basic mechanisms of disease, as well as the deciphering of the epigenetic code and advances in small molecule design and synthesis, personalised medicine for most diseases will become a reality. This will minimise side effects and reduce overall costs for the patient. Counselling patients, empowering them to decide on the best treatment options for themselves (whether for maintenance of health or therapy), will be an even more important skill for doctors in the future. Actress Angelina Jolie made headlines in 2013 by opting for a "preventive" double mastectomy after being found to have the BRCA-1 gene, a genetic marker that confers carriers with a 65% risk of breast cancer and 39% risk of ovarian cancer. Genetics provide additional information for more informed decisions about personal health and, in Angelina Jolie's case, changed her future.



IMAGINE A WORLD WITHOUT HOSPITALS

Nobody likes to stay in hospitals. We want to be cared for at home, with family close by. Patients will be increasingly empowered to learn about themselves so they can take care of themselves in the most comfortable and supported environment – at home. Advances in robotics, home monitoring, telemedicine and communications will be integrated to make this a reality. With the advent of wearable technology and improvement in health monitoring, doctors will be better able to acquire health data from a patient's smartphone, reducing the need to see the doctor at a clinic. The current trend of increasingly minimally invasive surgery, coupled with the use of precision robotics, suggests that future surgeries will be less intrusive and more automated. Future surgeries may be painless and preclude the need for anaesthetics, achievable with the use of ingestible microbots that can perform surgery from inside the body.

Delivering more humane, integrated, cost effective and safer care without hospitals, or at least hospitals as we know them now, will be a reality. "Primary" healthcare will be the new "Tertiary" care.

CONCLUSION

Although technology and science will radically transform the practice of medicine in the future, what will remain unchanged, at the heart of it all, is the doctor-patient relationship. When we are sick and most vulnerable, human beings will still prefer to engage and "trust" a fellow human being over a robot. The communion of kindred souls and the care of a fellow human being bring

healing beyond medicines and surgeries. Values such as professionalism, empathy and trust transcend time and technology. In fact, the more pervasive the technology, the more important it is to uphold these values in the doctor-patient relationship.

In view of impending disruptions to clinical practice, how should we imagine medical education and medical schools? Technology is a great knowledge leveler. Doctors and healthcare workers will not need to memorise all the evergreen medical facts and theoretical information, since factual information would be readily available anytime, any place, instantaneously. How then should we teach and prepare our students for future practice? Can we reimagine medical schools?

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THE FIRST FULL PROFESSOR OF FAMILY MEDICINE HAS BIG PLANS FOR TEACHING AND RESEARCH AT NUS

With more than 30 years of experience in general practice and primary care research under her belt, the first full professor in the Division of Family Medicine – Professor Doris Young – has her mind set on improving the family medicine curriculum at NUS Medicine, in line with Singapore's new focus on primary care.

Prof Young, who joined NUS Medicine in January 2017, plans to augment the small Family Medicine division by tapping on the expertise of practising family physicians to share their practical experiences through case discussions tutorials. In Prof Young's opinion, the current curriculum is too hospital-centric and not ideal for the training of family doctors. She believes that having more family medicine or primary care-centric case discussions could help to fill this gap.

"What would be the family doctor's role in managing diabetes better? What would be the family doctor's role in managing depression? We should pursue it through the eyes of a family doctor, not through the eyes of a hospital specialist. Because if you have too many hospital specialists teaching our Family Medicine residents, they will focus on the diseases seen and managed in the hospitals, rather than those problems seen and managed by doctors working in the community. Family doctors need a different kind of skills. I want it (this set of skills) more embedded in the curriculum," said Prof Young.

Patients in the community stem from different ethnic groups, backgrounds and economic status, and they may be dealing with other health problems apart from diabetes.

"As a family doctor, we need to look after this patient as a whole person. Instead of just biological, there is also the psychological aspect and social issues to deal with for having diabetes. As a good family doctor, we know this person over time. We know their stresses in life and the way they perceive and cope with illnesses," she said.

Prof Young, who is also the Associate Dean for the China Programmes at the Faculty of Medicine, Dentistry and Health Sciences at University of Melbourne, believes that practitioners such as herself should go beyond imparting

their practical knowledge to students and residents but also seek to inspire them as academic role models. She aims to share her career and life journey with the students in a bid to inspire them to take up academic family medicine as a career choice.

"The young doctors here need to see a role model, to see this is what a Professor of Family Medicine looks like — the teaching and research skills needed and the career paths taken to achieve that. Hopefully I could instill that passion in the next generation. And I would need to engage the whole Family Medicine community to work together," she said.

Another area Prof Young wants to focus her energy on is birthing a new research culture on topical general practice-related research that the country needs. Prof Young, who was responsible for strengthening Australia and Hong Kong's primary care research, believes that more research in family medicine would greatly complement Singapore's family medicine's academic standing.

"I want to call on all the family doctors here, those working in the polyclinics, Family Medicine Centres (FMC), private practices to form a primary care research network and say to them, let us all unite with nurses and allied health and build a research culture in family medicine in the primary care setting. We can do it. Research is not all just about dealing with animals, DNA, or laboratory-based research, there is good research that can be done in Family Medicine and primary care," Prof Young said.

To build a research culture centred in family medicine, Prof Young said NUS Family Medicine should collaborate with established researchers from other Schools, such as the Saw Swee Hock School of Public Health; specialists such as endocrinologists, psychiatrists and psychologists, and help to translate and implement their research into the wider community.

Prof Young's work does not just end in Singapore, she aims to link the local researchers with her global contacts to further research. She said more international collaborative research in the areas of chronic diseases, multi-morbidities, aged care, mental health and the global problem of antibiotics resistance would benefit Singapore.

"I (plan) to instill a research culture amongst the existing staff here, the medical students, residents, and the general practitioners out there. A lot of them are already doing good research work in their polyclinics. I want to link them up with the team here, and with my colleagues at the University of Melbourne, and internationally with other family medicine researchers, so that the younger doctors may follow," she said.

Having worked as a general practitioner in countries with strong primary care systems such as Australia and the United Kingdom, Prof Young believes Singapore still has

a bit to catch up on in terms of strengthening its primary care sector and changing public perception of family physicians. The family doctor-patient relationship and trust appears to be weaker in Singapore than abroad.

"An efficient healthcare system usually has a very strong primary care system. The respect from the public is very important, that every person or family should have a family doctor. In Australia, 90% of the people have a general practitioner. In the UK, it is 100%. In Singapore, many people head to the hospitals when they are ill. There isn't enough of a one-to-one (family doctor-patient) relationship here yet," Prof Young said.

Easing the unnecessary burden on Singapore hospitals and inculcating a "cradle-to-grave" mindset among the healthcare users would require government campaigns and media support.

"I think it would work through a multi-pronged approach, through the media to stress the importance of having a family doctor... and to strengthen the Division of Family Medicine by giving it appropriate resources, working with current practising family doctors, and bringing them together to share a common vision of family medicine in Singapore. Hopefully, the leadership here in NUS Medicine would show by example by building a strong academic department of Family Medicine," said Prof Young.

Family doctors and patients would also need to do their part. Doctors should upskill to maintain or regain public trust in their skillsets and expertise, Prof Young said. The public would need to trust their family doctors to diagnose and manage their problems.

Despite these challenges, Prof Young pointed out that Singapore has begun to place more emphasis on strengthening its primary care system.

"The timing is right. There is the primary care movement supported by the ministry; there is recognition of family medicine as an academic discipline. There is a lot of curriculum time now in NUS Medicine and the Lee Kong Chian School of Medicine, and we just need to enhance it."

During her time at NUS Medicine, Prof Young hopes to be able to establish a self-sustaining ecosystem for the Family Medicine Division.

"I hope to share my passion and enthusiasm for academic family medicine, and instill that in some of the young medical students and residents, so that I can leave behind and make some impact on the academic discipline of family medicine in Singapore, which will be sustainable for others to make their own mark on the future of the discipline."



FULFILLING HER NURSING DREAM

Lim Shi Min

Year 1, Alice Lee Centre for Nursing Studies
NUS Global Merit Scholar

Why did you choose to study at NUS and why the interest in nursing?

I wanted a university close to home as I am a rather family-oriented person. Of all the local universities, NUS was the most attractive as I really liked the inclusive, welcoming and vibrant school culture. My first visit to the university was when I got the opportunity to tour one of the residential colleges and I immediately developed a liking for this place. My second visit reaffirmed my decision to study at NUS, and that was during the open house. The place was jumping with vibrancy, altogether so welcoming and encompassing. I could really see myself learning, growing and developing as a person in this nurturing environment. Working in the healthcare sector has always been my passion. Personally, I feel that I am someone who enjoys the company of people and caring for others. Contrary to popular belief, nursing is not a career where nurses only help patients to maintain their

personal hygiene and merely serve as doctors' assistants. The role of a nurse is far larger than these perceptions. Nurses are the ones standing by the patients, providing physical, emotional and mental support, and providing them with a holistic form of care for the patients. I feel that nursing is too much of an underrated job and the public is still entrenched in the mindset that nursing is not a desirable career option. I chose nursing because other than being a patient advocate, I also want to become the nurses' advocate, promoting nursing as a career. I want to show that nursing encompasses so much more than one can ever imagine.

Tell us more about the NUS Global Merit Scholarship and how it has assisted you?

Receiving the Global Merit Scholarship has been an incredible yet humbling experience. I took up this offer without hesitation because of its bond-free nature. It



provides the scholar with so many opportunities to grow as an individual and it does not restrict you in terms of the type of activities and programmes you want to join. This scholarship allows me to fully utilise my undergraduate years to explore all the opportunities available for nursing degree holders before I finally set my sights on what I truly want to do, and where I want to be. The scholarship also helps to ease my financial worries.

How has NUS helped in your overall development?

There are so many programmes that NUS offers which are outside of our undergraduate courses that sometimes I am overwhelmed! I strongly believe that learning should not only take place in the auditorium or tutorial room; rather, it should occur every minute, every second of our lives. As long as there's an opportunity to learn something new, seize it. The programmes offered by my school alone, regardless if it's student-initiated or faculty-led, have all been so attractive. Most of the programmes are centered around community service (because in medical school it is about the heart of giving) and those I joined really helped in shaping me to become someone who can empathise more and feel for others. Empathy does not come easy, because we would tend to sympathise with others rather than put ourselves in their shoes and see from their perspectives. These programmes taught me things I would never have learnt in school, and I feel that together with the nursing skills I have picked up, they

will really shape me to become a better nurse, a nurse with both "hard" and "heart" skills.

Have you been inspired by any faculty member during your time here in the University?

Indeed I have, even though it is only the first semester! I have met some amazing lecturers during my first semester at university. One of them is Dr Shefaly Shorey. She has been such an encouraging and inspiring role model. Her enthusiasm and constant desire to learn really motivates me to adopt a positive outlook in life and keep alive the spirit of learning. One day, I hope to become a nurse researcher and also take on the role of educating nursing students, to be proud of the work they are doing. Hopefully I will get to see the day when nursing becomes a respected and recognised profession.

Do you stay on campus? If so, which hall? What do you like about living on campus?

Yes I do! I am currently staying at Tembusu College! It is such an incredible and amazing place to live in. Convenience aside, staying in a residential college enables me to learn so much everyday. My favourite part of staying in Tembusu is attending the tea sessions organised. Every week, there is a talk on an area of interest and often, renowned speakers will be invited to share their thoughts and experiences on their area of specialty. These tea sessions have served to broaden my perspective of things



and some have even challenged my worldview. Perhaps the things we perceived to be true might not be true after all. I feel that there is no way that every one of us will get to experience everything in a single lifetime, and it is good to be able to hear from others, to share their experiences, thus I particularly enjoy these tea sessions. Also, I enjoy the company of my friends living here, especially the conversations we have. They range from simple and comforting, to thought-provoking and intellectually stimulating. There is never a day wasted living in Tembusu.

What are some of the activities you took part in during your time in NUS?

As I am only in my first semester of study, the activities I am currently involved in may not be as comprehensive. Nonetheless, I enjoy everything that I am currently doing. In my faculty, I participated in several community programmes such as being a supervisor for the Public Health Service, where we went down to Clementi to conduct free health screening for the public. I also volunteered in the 'We Will Dance' dance marathon that was jointly organised by the University Scholars Programme and in which I had a chance to help out. I am also part of the Rotaract Club in NUS, where I head down to a community centre to conduct weekly reading activities for the kids to promote good reading habits. In my college, I am part of two interest groups, namely Urban Gardeners, which comprise nature enthusiasts, and Yarn and Doodles, where we gather to do art and craft activities. I am also in the midst of preparing to start a new interest group next semester!

How do you juggle your university commitments with your other commitments?

I think striking a balance between both is important. As a student, I have a responsibility to do well academically so as to fully maximise my university education. At the same time, I am also obliged to take charge of my other university commitments since I was the one who expressed interest in the first place. Time management is essential in achieving a good balance of both. I guess it helps to have a weekly schedule so as to better keep track of things, as it may get quite busy at times!

What advice will you give to prospective students?

Don't jump to sign an offer letter so soon, just because the benefits are really attractive. Evaluate your options and prioritise what matters to you most. Ultimately, it lies in your own interest and how you envision yourself to be in 10 or 20 years' time. Always be open-minded when deciding on a university to study at and if you are lucky enough, your scholarship offers, because in the end you will be the one living your decision.



A PASSION FOR YOGA

Where do you go for free yoga classes? Right here, at the Dean's Office, where Ms Lena Yoong conducts free, twice-weekly introductory classes for staff.

Secretary to one of the Vice-Deans by day, wife and mother at home, Lena has been practising yoga since 2001.

"Yoga keeps me happy and healthy. It calms my mind and I feel more relaxed. I used to experience stress while juggling care for three kids, and was suffering from insomnia, migraines and terrible backaches. I felt much better after practising it. Yoga is more than just the postures, it is a way of life, and I hope to inspire others to try it," said Lena, who earned a teaching certificate in the discipline recently and started her first class near her home at Nee Soon Community East Centre. She was apprehensive at the beginning, but that gave way to growing confidence as she gradually trained and mastered each move.

Her interest grew into a passion for teaching. When the classes were discontinued, she sought the guidance of another yoga master. Within a few years, she was leading her own class of 30 people together with three of her friends.

In her classes, Lena never fails to go back to the basics of posture and breathing. She makes it a point to ensure that her students do their postures correctly without going against their body limits.

Dr Khor Ing Wei from the Department of Medicine has been attending Lena's classes since they began. "My shoulders tend to be stiff from long hours of sitting at work. The yoga sessions led by Lena were really helpful in loosening the tightness in my body. I feel refreshed, calm and positive after the sessions, which gives me more energy for the rest of the day."

Lena demonstrating a yoga pose known as The Plow.

And that comes from correct breathing, says Lena. "We live in a very rushed and hurried life, and we need to be conscious of our steps and breathing. In yoga, having an erratic breathing means a troubled mind. Our goal is to find the point in our mind-body balance where we can breathe with ease and in sync with the flow of our body's movement in yoga postures through a deep inhalation and exhalation process," shared Lena. "Listening to your body is important. It prevents your muscles being overstretched and prevents injuries. Another important aspect is focus and discipline, and our goal is to find the right alignment and posture."

Outside of work and yoga, Lena relishes time with her family, from daily meals to annual holiday trips. She once ascended Mount Rinjani in Lombok, Indonesia, with the encouragement of her husband, Jerry, and her three children — Leona, 28, Janel, 26, and Jeremy, 22. Leona is a full-time teacher at a special needs school and a part-time swimming instructor; Janel recently moved to Timor-Leste to pursue a career in Marketing Communications and Jeremy is studying part-time at the Singapore University of Social Sciences (formerly known as UniSIM), and working full-time as a communication executive at the Singapore Turf Club. The arrival of her first grandson in March 2017 sparked a new interest — post-natal yoga, which she hopes to teach to her daughter.

Why pay for yoga classes costing as much as \$60 each, when you could sign up for reasonably priced personalised sessions with Lena, who retires from the School at the end of May after five years of service? Yoga, anyone?

If you or someone you know would like to find out more about Lena's yoga classes, please go to liveyogabreatheyoga.wordpress.com

POOR SLEEP QUALITY AND DEPRESSION COULD TRIGGER DEMENTIA



There is increasing evidence linking the onset of dementia to poor sleep quality and depression. Both have been identified as key risk factors, along with traumatic injury to the brain, said Professor Kristine Yaffe, a visiting expert on dementia from the University of California in San Francisco.

Prof Yaffe, this year's Oon Chiew Seng Speaker, was here in March to speak about research in this field. She said that that these findings add to what scientists already know about diabetes and obesity and the risk they pose to adults and middle-aged people. Dementia, the debilitating and life-sapping illness that robs sufferers of their memory, identity and dignity, affects more than 46.8 million people worldwide. In Singapore, dementia affects 40,000 people today; the number of people diagnosed with the illness is expected to double to 80,000 by 2030.

In two lectures delivered at NUS Medicine, Prof Yaffe dwelt on ways to prevent dementia through changing lifestyle factors and the link between sleep and the risk of dementia. The lectures are part of the Oon Chiew Seng Distinguished Visitor Programme, established in 2011 through a donation by NUS Medicine alumna Dr Oon Chiew Seng to bring in world-renowned experts to share their knowledge.

"Many, many things change with ageing in terms of sleep, and it is becoming very clear that this is something we

have not paid enough attention to, and that there are huge connections with metabolic disease, cardiovascular disease, and dementia," said Prof Yaffe.

POOR SLEEP

Sleep disturbance is common in older adults and affects up to 50% of older people, said Prof Yaffe. These older adults suffer from decreased sleep quality, overall less restorative sleep, shifted circadian rhythms and sleep apnea.

Studies have shown that poor sleep quality may be a risk factor for cognitive impairment and dementia, but these epidemiological investigations have been limited by cross-sectional design and subjective measures of sleep quality.

Professor Yaffe's recent studies on older adults have linked objectively measured sleep variables, including sleep efficiency, changes in sleep architecture, and periodic limb movements, to cognitive impairment. These findings also suggest that these associations may be bidirectional. Abnormal circadian rhythms and sleep disordered breathing may also increase the risk of dementia, according to Professor Yaffe's research.

While further exploration of the mechanism of these associations is needed, modification of sleep quality could be a promising target for dementia prevention, as sleep disorders and disturbances are often treatable, she said.



Professor Kristine Yaffe giving a public lecture on lifestyle factors that could prevent dementia, at the NUHS Tower Block Auditorium on February 27, 2017.

DEPRESSION

Another likely culprit responsible for the onset of dementia is depression, according to research. The earlier depression or its symptoms are treated, the lower the likelihood that it will lead to dementia, said Prof Yaffe, whose research proved that the burden of depressive symptoms over time increases the risk of dementia. She suggested that older adults should be monitored more aggressively for the onset of new depressive symptoms.

"Public health strategies at the societal level can impact dementia trends, in addition to improved education and economic well-being," she added.

Traumatic brain injury too increases the risk of dementia, though more research on treatment and rehabilitation needs to be done to potentially reduce dementia risk in future, added Prof Yaffe.

LESSONS FOR SINGAPORE 1: WORK YOUR BODY

The two things Professor Yaffe believe Singaporeans can do to prevent dementia are engaging in physical activity and keeping cardiovascular disease at bay.

"My understanding is that people now are less active than they used to be, and there are a lot of heart disease risk factors such as diabetes, hypertension and stroke. These two areas are important for dementia, and they seem to have a lot of connections for Singapore. The world should expect more research studies on dementia in time to come. But for now, everyone should take responsibility in delaying dementia."

Referring to a 2001 study of 5,925 elderly women in their seventies and eighties, Prof Yaffe said she found that the more blocks they walked in their neighbourhoods over six to eight years, the less they suffered from the risk of cognitive decline. It also showed that exercising improves cognitive function in older adults with memory complaints.

LESSONS FOR SINGAPORE 2: WORK YOUR MIND

Observational studies have also shown that dementia is lower in people with more education, higher intelligence quotient (IQ), and greater occupational achievement, as well as in those who engage in mentally stimulating leisure activities. This was supported by another piece of research, in 2011. It showed that, in older adults without dementia, lower amyloid beta (β -amyloid) 42/40 levels – amino acids in human brains known to cause Alzheimer's disease were not as closely associated with cognitive decline over nine years in more highly educated people than in those with a lower-than-high-school education. These results are important as biomarkers such as plasma β -amyloid are relatively easy to obtain and minimally invasive, and can contribute to better dementia treatment.

While a cure for dementia may not be on the horizon, Professor Yaffe believes that more research on dementia and its risk factors will allow for better treatment in future.

"I'm not sure I see a cure, but I think we will have much better medications, and my prediction is that dementia will be like heart disease, where you give (the patient) a couple of different medications combined with lifestyle (changes). We need not ever be able to cure or have the disease go away completely, but we will be able to manage it better so the symptoms are less and do not progress as quickly," she said.

For those afflicted with dementia, a change of perspective and preventing a worsening of the symptoms may be all they need.

"Once somebody has dementia, you cannot expect to go back to when you were 30, but you can have other ways of having meaning and quality of life and productivity. You have to change your perspective. You want to be active, so doing things, stimulating your brain, moving your body, connecting with people are all very important. The other one is preventing cardiovascular disease risk, and taking what is good for the heart, that is good for the brain."



BEING A CAREGIVER

By Dr Noreen Chan
Head & Senior Consultant, Division of Palliative Care,
National University Cancer Institute, Singapore (NCIS)

The family conference was convened in a spare room in the busy cancer ward, to update family members and to discuss care arrangements. Mr K, the patient, did not attend as he felt tired; in any case, he had said he had no particular preference and would defer to his family. His wife and daughter J had very different but equally strong opinions - Mrs K wanted to take her husband home, while J wanted to let her father be cared for in an inpatient hospice.

J shared that the patient had been a drinker and gambler and was verbally and physically abusive. He had abandoned the family for a number of years, only coming back when he became ill. "I don't

understand why my mother still tolerates his nonsense!" Mrs K, on the other hand, said simply "whatever happened in the past, he is still my ah lau (husband)."

Both parties held firm, and both positions seemed reasonable. So while it was useful to get the facts and feelings out in the open, we were no closer to the answer of where Mr K would be cared for, and who would take care of him.



Such scenarios highlight that caregiving is not as straightforward as we would like to believe, and although most of us will one day be caregivers and/or need care ourselves, we do not give the matter much thought, let alone make preparatory steps, until we are eventually forced to.

WHAT IS A CAREGIVER, AND WHO ARE OUR CAREGIVERS?

A caregiver is someone who either provides hands-on care, or ensures that care is provided, which could be paying for services or care providers, or handling coordination or organisation tasks. Most caregivers are family members and in Singapore, there are also a large number of foreign domestic workers (FDWs) who are engaged to provide physical care.

The Ministry of Culture, Community and Youth-supported Survey on Informal Caregiving (conducted in 2010) found that in Singapore, caregivers of elderly people aged 75 years and above at home were mainly female (60% of respondents). While three quarters of caregivers were children (more daughters than sons), 16% were spouses, who were themselves elderly. Half of the caregivers engaged FDWs to provide care, although only 45% of the FDWs had any prior experience or formal training in caring for the elderly.

WHAT IS THE “COST” OF CAREGIVING?

The AARP and National Alliance of Caregivers in the USA estimate the economic value of care provided by family caregivers – typically female, generally unpaid – as US\$470

billion a year. There is no corresponding information for Singapore, but there is certainly a financial impact, as the cost of home care services is not usually covered by insurance or Medisave, and requires cash payment.

What other “costs” are there and what is the impact on the caregiver? The same Survey on Informal Caregiving found that on average, respondents spent 38 hours per week giving or ensuring care for the elderly care recipient. Caregiver stress correlated with increasing disruption to the caregiver’s own schedule or pressure from financial or health problems, and was also increased if the care recipient suffered from depression. Spousal caregivers were more likely to be negatively impacted by their caregiving role than were children caregivers.

Yet many caregivers also derive great fulfilment and satisfaction, and like Mrs K, want to provide care as long as they can. So the whole experience of caregiving, like any human activity, is not just physical, but has social, cultural, emotional and psycho-spiritual dimensions.

WHAT HELPS?

Being adequately prepared for the practical tasks at hand is an important first step – such as obtaining information about what to expect, training, equipment, etc. Fortunately, there are resources here, both in the hospitals and in the community, including websites like AIC (Agency for Integrated Care) and Singapore Silver Pages. Hospitals have medical social workers and care coordinators who can help patients and families navigate the sometimes bewildering array of services and subsidies.

Caregivers also need to be aware of the importance of self-care, to prevent exhaustion and burnout. Support for caregivers can come from a variety of sources, such as friends, family, other caregivers, faith communities, support groups and professional care services. A survey conducted by our hospital found that caregivers of cancer patients receiving hospice home care had better quality of life than caregivers who were not similarly supported.

Support can come in many forms; sometimes seemingly small acts can make a big difference. When a friend of mine in New Zealand was caring for her husband, she found it enormously helpful when other friends came over for a few days to do housework and cook, so that she could concentrate on caregiving.

KNOWING ONE'S LIMITS, KNOWING ONE'S ROLES

Adult children may find themselves juggling multiple responsibilities and "caught" between caring for their ageing parents and their young children. Welcome to the "sandwich generation"! In our increasingly globalised society, families are increasingly scattered across time zones, and children may also have to grapple with rendering care from a geographical distance.

Caring for one's parents can be tricky because they may disagree that they need care and/or have their own ideas about what should be done. It does not matter if you are the CEO of a multi-national company: the parent-child relationship is always there, and since you cannot put Dad or Mom in the naughty corner, you just have to negotiate.

No one needs to get it right the first time, and it is fine not to know all the answers. It is a learning experience and a time of adjustment for everyone, not only for the caregiver, but frequently for the care recipient as well. It does not have to be perfect, just good enough.

ARE HEALTHCARE PROFESSIONALS

"BETTER" CAREGIVERS?

Healthcare professionals may have the advantage of having "inside knowledge" of the system, more people to contact, and the ability to pull certain strings. Often, medical colleagues, knowing the patient is your relative, may go the extra mile. But ironically, this may put the patient at a disadvantage.

A fellow Palliative Care specialist and I were reflecting that both our fathers had heard about their cancer diagnoses after their children did, despite being retired senior doctors

themselves. I appreciate that our concerned colleagues wanted to ensure we were kept in the loop, and in some way my father did not have to break the bad news to me himself. But I had to remind various doctors along the way that my father was perfectly capable of making his own care decisions.

No doubt about it, I was glad to have been able to open doors for my father – having been "Dr Chan" in his own right for 50 years, he would tell friends about the unusual experience of being introduced throughout the cancer centre as "Dr Chan's father". We disagreed on certain points about his choices, but I decided these issues were not worth fighting about. But when all was said and done, I felt the most gratification when I took on the caregiving role I was most qualified to do, and that was to be his daughter.

THE BRIDGE by Joy Cowley

*"There are times in life
when we are called to be bridges,
not a great monument spanning a distance
and carrying loads of heavy traffic
but a simple bridge*

*to help one person from here to there
over some difficulty
such as pain, fear, grief, loneliness,
a bridge which opens the way
for ongoing journey.*

*When I become a bridge for another,
I bring upon myself a blessing, for I escape
from the small prison of self
and exist for a wider world,
breaking out to be a larger being
who can enter another's pain
and rejoice in another's triumph.
I know of only one greater blessing
in this life, and that is
to allow someone else
to be a bridge for me."*



JUSTICE AS A LENS FOR ONE HEALTH IN MANAGING EMERGING INFECTIOUS DISEASES

By Tamra Lysaght^{1*}, Benjamin Capps²,
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National University Health System, Singapore

In the last 20 years, Asia has been a hotspot for emerging infectious diseases, the majority of which have been zoonotic in origin – meaning that they are shared between humans and animals. Severe Acute Respiratory Syndrome (SARS), Nipah virus, A H5N1, A H7N9 and other novel avian influenzas are zoonoses that have emerged from within Asia. These and other zoonotic Emerging Infectious Diseases (zEID) have significant impact on public health. Governments in the region and international agencies such as the World Health Organization are on high alert to respond to any potential threats.¹

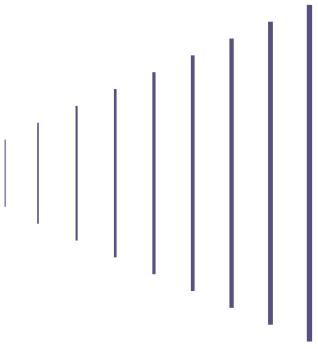
Singapore has a significant role in the prevention and control of zEIDs in Southeast Asia, and based on its experience with SARS in 2003, has developed multi-agency planning and infrastructure to respond to zEID threats. This was activated during the outbreak of influenza A H1N1 in 2009.² In 2012, the government created a One Health (OH) platform to bridge gaps and strengthen cooperation between the three government agencies responsible for human health (the Ministry of Health – MOH), food safety and animal and plant health (Agri-Food & Veterinary

Authority of Singapore – AVA), and the environment (National Environmental Agency – NEA).³

The OH approach has been described as the cross-disciplinary collaborative effort of researchers and policymakers working locally, nationally and globally to “attain optimal health for people, animals, and our environment”.⁴ It advocates for an ecological perspective covering human and non-human health, drawing attention to the linkages between socio-economic, cultural and environmental factors that shape our understanding of zEIDs across species.⁵ However, despite endorsements from numerous organisations – including the U.S. Centers for Disease Control and Prevention, the WHO and the World Organisation for Animal Health (OIE) – OH currently lacks an ethical foundation.

and city-states (including Singapore) should play a greater role in helping to manage the regional circumstances that cause zEIDs to spill over into human populations in the first place. As global citizens, Singaporeans have an interest in tackling these conditions even in predominantly rural regions, because endemic zoonotic pathogens can rapidly decimate human and animal populations in low-resourced settings and spread into neighbouring countries, causing widespread morbidity, mortality and even socio-economic instability. Those diseases can develop into pandemics through international trade and travel channels. As a major global hub, Singapore can be better prepared through wider investment in regional OH infrastructure. We can also share our expertise in responding to zEIDs through expansion of existing programmes and collaborations.

AS GLOBAL CITIZENS, SINGAPOREANS HAVE AN INTEREST IN TACKLING THESE CONDITIONS EVEN IN PREDOMINANTLY RURAL REGIONS BECAUSE ENDEMIC ZOONOTIC PATHOGENS CAN RAPIDLY DECIMATE HUMAN AND ANIMAL POPULATIONS IN LOW RESOURCED SETTINGS AND SPREAD INTO NEIGHBOURING COUNTRIES, CAUSING WIDESPREAD MORBIDITY, MORTALITY AND EVEN SOCIO-ECONOMIC INSTABILITY.



A multi-disciplinary group of researchers from the NUS Centre for Biomedical Ethics, the Department of Medicine, the Department of Physiology, the Department of Biological Sciences and the Saw Swee Hock School of Public Health set out to address this gap in a project funded by a Communicable Diseases: Public Health Research Grant from the Ministry of Health. This project was a mixed methods study that engaged local opinion leaders on the conceptual and ethical priorities of the OH approach in Singapore. Key findings from this project, recently published in PLOS One, suggest that the experts felt that zEID planning under an OH approach would benefit greatly from an ethical ecological framework that accounts for justice in human, animal, and environmental health.⁶

Justice is commonly conceived as fairness, relating to fair distribution of resources and burdens.⁷ Although justice is well studied in public health, conflicts also arise around the fair distribution of benefits and burdens between human and animal populations. Viewed through the lens of justice, OH should broaden the ethical discourse to include zoological and ecological concerns. In addition, urban cities

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SCHEDULER

May – July

Date	Event & Venue
May 11-12	Workshop: Interactive Teaching-Learning Strategies in Small & Large Group Settings Multi-Purpose Hall 3, Level 3, Tahir Foundation Building, MD1, NUS
May 15-18	Workshop: Simulation as a Teaching Tool – Instructor Course Centre for Healthcare Simulation, Level 3, Centre for Translational Medicine (CeTM), MD6, NUS
May 20	Standardised Patient Day Centre for Translational Medicine (CeTM), MD6, NUS
May 23-26	Workshop: Simulation as a Teaching Tool – Instructor Course Centre for Healthcare Simulation, Level 3, Centre for Translational Medicine (CeTM), MD6, NUS
May 23	Workshop: Competency Based Medical / Health Professional Education – Providing Effective Feedback to Enhance Learning Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
May 24	Workshop: Flipped Classroom Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
May 24	Workshop: Use of Videos in Medical Education Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
May 25-27	13th International Conference on Clinical Ethics Consultation Grand Copthorne Waterfront Hotel, Singapore
May 30	Workshop: Scholarship of Teaching and Learning Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
May 31	Workshop: Qualitative Research Methods in Health Professions Education Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
Jun 6-7	Workshop: Assessment of Practical / Clinical Skills – Workplace-Based Assessment Room 03-04, Level 3, Centre for Translational Medicine (CeTM), MD6, NUS
Jun 13-16	The Seventh International Meeting on Synthetic Biology (SB7.0) University Cultural Centre, NUS

Details may be subject to change at the discretion of the respective departments without prior notice.

SCHEDULER

May – July

Date	Event & Venue
Jun 28	Workshop: Learning Outcomes and Entrustable Professional Activities (EPA) Multi-Purpose Hall 1, Level 3, Tahir Foundation Building, MD1, NUS
Jun 30-Jul 1	4th National University Cancer Institute, Singapore (NCIS) Annual Research Meeting Auditorium, Level 1, & T09-03/04, Level 9, NUHS Tower Block
Jul 3	Medical Dinner Raffles City Convention Centre, Level 4, Padang & Collyer Ballrooms
Jul 6-7	International Conference on Scientific Frontiers in Natural Product-Based Drugs Auditorium, Level 1, Clinical Research Centre (MD11), NUS
Jul 8-9	RadioPath T06-02/03, Level 6, NUHS Tower Block
Jul 8	Commencement Ceremony University Cultural Centre, NUS
Jul 12	Workshop: Assessment of Practical / Clinical Skills – Multi-Station Examinations Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
Jul 13-14	Workshop: SHARE Workshop, Drug Discovery, Past and Future Auditorium, Level 1, Centre for Life Sciences (CeLS), NUS
Jul 17-21	International Union of Microbiological Societies (IUMS) Singapore Sands Expo & Convention Centre
Jul 19-20	Singapore Gastric Cancer Consortium's 10th Annual Scientific Meeting Auditorium, Level 1, NUHS Tower Block
Jul 21	Workshop: Use of Portfolio in Assessment and Learning Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS
Jul 25-26	Workshop: Competency-Based Medical / Health Professional Education – Written Assessment Learning Room 01-01B, Level 1, Centre for Translational Medicine (CeTM), MD6, NUS

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