

MediCine

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EXPLORING HEALTHCARE AND CULTURE IN CHINA'S SOUTHWEST



DEAN'S MESSAGE



Dear Reader

Fourteen years ago, the National University of Singapore introduced an undergraduate nursing degree. Taught by experienced faculty with extensive nursing experience gained here and abroad, the pioneer batch of graduate nurses has gone on to make their mark in various healthcare roles throughout Singapore.

They have been joined over the years by over a thousand other NUS Nursing graduates. Working alongside other healthcare colleagues, NUS Nursing graduates have contributed immensely to the health and well-being of Singaporeans from all walks of life. This year, the Alice Lee Centre for Nursing Studies celebrates the 10th anniversary of the graduation of that inaugural Nursing Class of 2009. That first class numbered about 50 graduates. Today, the graduating class numbers stands at 197.

The setting up of the Centre as a department within the Yong Loo Lin School of Medicine in 2005 has also enabled many synergies within the School over the last 14 years. Chief among these was paving the way for future nurses and doctors to learn together, allowing them to benefit from better understanding and knowledge of one another's profession. Interprofessional training helps them see one another's point of view and learn better teamwork and communication.

The Centre's research output has also been equally impressive, propelling the Centre to pole position in the Asian ranking of nursing programmes, and to place among the top 20 programmes globally.

With NUS Nursing, Singapore has a degree programme that has helped raise the public perception of nursing and professionalised the image of nurses. Today, nurses' inputs are sought in the development of care and formulation of policy. It is a much higher level of practice than 20 or 30 years ago.

As we look ahead, I am confident that Nursing will play an even bigger role in the planning and delivery of care, especially when the focus of care shifts beyond hospitals. This is where our graduate nurses will come to the fore. They are the best professionals to deliver care in the community, as the population gets older and more chronic care is required.

The next time you encounter our nurses, please take a moment to congratulate them. They do us all proud.

On an equally happy note, I am pleased to introduce our School orchid, the *Vanda* NUS Medicine. The orchid is distinguished by its base yellow colour and tessellations that range from orange to crimson red - colours that correspond to those on the hoods of academic gowns worn by Medicine (red) and Nursing (lemon yellow) graduates.

A cross between *Vanda* Kultana Fragrance and *Vanda* Memoria Thianchai, the free flowering hybrid's hardy and adaptable nature is an apt expression of the characteristics that denote the Yong Loo Lin School of Medicine graduate. More about the *Vanda* NUS Medicine and its merchandise will be featured in the next issue.

The School orchid was unveiled to a 700 strong rousing crowd of invited guests and donors, graduates, faculty, as well as executive and professional staff at this year's Medical Dinner. Held annually to welcome the graduating Medicine and Nursing classes to the healthcare fraternity, the dinner this year paid tribute to the School's founding donor, Mr Tan Jiak Kim. Thanks to his far-sighted vision of a medical school to train doctors to care for the local community, and the unstinting support of many donors over the years, the School has grown by leaps and bounds to become Asia's leading medical institution of higher learning and research.

Happy reading!

Yap Seng

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Pharmacology Department in 1959 at Hallower Hall on Sepoy Lines campus

NUS PHARMACOLOGY

Celebrating 60 Years of
Education and Research

By Associate Professor Fred Wong,
Head, Department of Pharmacology

Mention the numeral “60”, and many of us would think of the Merdeka Generation – the generation that worked hard and contributed to Singapore’s achievements today. But to many in the NUS Yong Loo Lin School of Medicine, especially staff of the Department of Pharmacology, there is another significance to 60, as we associate it with the 60th Anniversary of the Department in 2019!

Our Origins

The Department of Pharmacology was first established in 1959 and located in the Hallower Hall on the Sepoy Lines campus. In early 1982, the Department relocated to MD2 building at the new Kent Ridge campus. In 2007, in support of a major campus re-development plan, the Department was temporarily moved to MD11, Level 5.

In 2015, the Department finally relocated to our current premises in MD3.

Pharmacology “Champions”

With capable leaders to provide direction and vision, Pharmacology has grown from strength to strength. The contribution and commitment of the Heads of Department have been crucial to the development of the Pharmacological Science and we take this opportunity to acknowledge their leadership.

In 1959, Dr. Robert C.Y. Lin became our first Head of Department. He was subsequently appointed the first Professor of Pharmacology in 1962. Prof John E. Gardiner of the Royal College of Surgeons of England took over as Head from 1966 to 1981. Prof Yeoh Teow Seng took over the reins from Prof Gardiner in 1981 and relinquished the Headship in 1987. He was succeeded by Prof Matthew C.E. Gwee, who handed the baton over to Prof Lee How Sung in 1987. Prof Edmund J.D. Lee helmed the department from 1999 to 2000, and Prof Peter T.H. Wong as Acting-Head from 2000 to 2003, before the arrival of Prof Philip K. Moore from King’s College, London who took over as Head from 2003 to 2007. Prof Peter Wong became Department Head and

DOSSIER



Pharmacology Department at MD3 on the Kent Ridge campus since 2015

served till 2014. The current Head of Department is Assoc. Prof Fred W.S. Wong who assumed duty since 2014.

Pharmacology “GEMS”

The Department has grown in strength and diversity over the years and today has 16 academic staff, 4 joint academic staff, 14 adjunct academic staff, 12 laboratory technologists, 5 administrative staff, 3 operation associates, 13 research fellows and 17 research assistants. The Department offers research training in Pharmacology at both undergraduate and graduate levels. We have currently some 30 graduate students pursuing PhD qualifications, more than 40 undergraduate honors and students from the Undergraduate Research Opportunities Programme (UROPs) conducting pharmacology research projects. We teach at least 1000 undergraduate students from various disciplines including Medicine, Nursing, Dentistry, Pharmacy and Life Sciences in 17 modules.

Pharmacology has a strong team of academic and research staff committed to excellence in pharmacology education and research missions. Our team has diverse research training backgrounds, from clinical pharmacology, systems pharmacology, to basic molecular and cellular pharmacology. The department offers a broad range of teaching and research specialties from pharmacokinetics, drug-receptor theory, drug targets identification and validation, agonist and antagonist drug discovery, molecular and cellular mechanisms of drug actions, disease-specific system pharmacology, drug modality development, pharmacogenetics and personalised medicine, drug development and clinical drug trials, to adverse drug reactions and toxicology.



*Photo of Pharmacology staff taken in 1967 (4 HODs in the photo)
Front row: John E. Gardiner (L1), Lee How Sung (middle), and Matthew C.E. Gwee (R2). Third row: Yeoh Teow Seng (L1)*



*Photo of Pharmacology staff taken in 2018 during Department Retreat in Sentosa, Singapore (3 HODs in the photo)
Front row: Peter T.H. Wong (R2) and W.S. Fred Wong (R5).
Second row: Edmund J.D. Lee (L3)*

DOSSIER



Medical students class, 1960

Pharmacology is the anchoring department for the Memory Aging Cognitive Center (MACC), the Neuroscience Phenotyping Core of the NUHS, and the Drug Discovery and Optimization Platform (DDOP) of the Medical Sciences Cluster. Prof Philip K. Moore is heading the Drug Development Unit (DDU) at the University Level and Prof Dean Ho, our joint faculty staff member from Bioengineering, is the Director of the SINAPSE Programme. The department also has a strong presence in the University-level research institutes, including the Cancer Science Institute (CSI), the Neuroscience Programme and the Immunology Programme. In addition, we are building up scholarly research in Education via a team of educators and educationalists who work closely with the Medical Education Unit at NUS Medicine.

The department also places great emphasis on workplace safety and has won recognition and awards for its relentless efforts and contributions to promote Safety and Health Excellence at work. We are one of the first departments to win the NUS Safety & Health Award (NUSSHA) Excellence Award 2017.

Pharmacology “Happy Souls”

Care and Teamwork are core values that the Department strongly believes in. We organise regular get-togethers and team-building sessions, including bowling, gardening day, monthly fruit fiesta, Chinese New Year “Lo Hei” luncheons and Hi-Tea, visits to places of attraction including the

Sentosa Sea Aquarium, and Madame Tussauds. We also have aerobics, nature walks and many other fun outings.

Next Chapter

This 60th anniversary year is a memorable and special one and a series of activities will commemorate this milestone. They include the Bioactive Lipid Workshop, Alumni Symposium, and the International Conference on Pharmacology: Advances in Translational Sciences & Drug Discovery. Looking forward, we aim to build stronger research capabilities and partnerships to facilitate our drug discovery and development efforts and aspire to create more value in education for our students. But for now, it's simply:

“Happy 60th Birthday Pharmacology!”



A class in session, 2019



Prof Chong Yap Seng (left) and Minister for Education Ong Ye Kung (far right) officially unveiling the Vanda NUS Medicine.

NUS MEDICINE CELEBRATES HERITAGE AND TIES

A new addition to the orchid family, the *Vanda* NUS Medicine, was unveiled at the annual Medical Dinner as a tribute to the tenacity and industry of everyone who helped shape the teaching and practice of medicine in Singapore. The dinner, themed “Celebrating our Heritage” was held on 3 July, marking the day the school was established in 1905. Attended by students, faculty and alumni from the NUS Yong Loo Lin Medical School (NUS Medicine) and the NUS Alice Lee Centre for Nursing Studies (NUS Nursing), it offered the NUS medical community a chance to build and rekindle bonds and also served as a welcome for the newest nursing and medicine graduates into the profession.

The orchid has a base yellow colour and tessellations that range from crimson red to orange, calling to mind the hoods of the academic gowns worn by graduates from NUS Medicine – red, and from NUS Nursing – yellow. It was chosen for its hardy and adaptable nature,

which are some of the ideal characteristics of an NUS Medicine graduate.

Reminiscing on the years past, Dean of NUS Medicine Professor Chong Yap Seng said that the School has done well, but can always do better. He recounted the analogy which his predecessor Associate Professor Yeoh Khay Guan used for the School’s path forward – climbing Mount Everest. The view is different now, he opined. “You can see that we are now a lot closer to the summit, but the way up is choked with many other climbers; a reflection of the intensifying global competition. But we should not worry if we just remain focused on the things that are important and doing them to the best of our abilities. And we will do them together, one step at a time,” he said. Prof Chong also paid respect to Mr Tan Jiak Kim who initiated the fundraising efforts that led to the School’s founding in 1905.

Guest-of-Honour at the event, Minister for Education Ong Ye Kung reminded the medical community of the need to earn and preserve public trust. He emphasised the importance of being competent, upholding the code of conduct, contributing back to society and above all, staying true to the ethos to serve. “We place the people we serve – be it patients, students or citizens – at the centre of all that we do. For medical professionals, this

DOSSIER



Minister Ong and dinner guests enjoying their time at the dinner.



comes back to your pledge to make the health of the patient your first consideration and to respect the dignity of patients under your care. The day we waver from this, we will no longer be fit to serve," he said. He urged the graduates to serve their patients with compassion and integrity and to go above and beyond clinical obligations.

Prominent alumni from NUS Medicine and NUS Nursing were honoured at the Dinner. The Alumni Awards included the Young Alumnus of the Year that recognised young alumni who have distinguished themselves in their chosen fields or paths less taken; the Alumni Ambassador of the Year that highlighted alumnus or alumna who have greatly contributed to the School in time or talent; as well



as the Alumnus of the Year that honoured an inspiring alumnus or alumna with national or global contributions and achievements.

This story was first posted on [NUS News](#) on 10 Jul 2019.

NEW GASTRIC CANCER PROGRAMME COMBINES MOST PROMISING RESEARCH AND CLINICAL AVENUES

By Dr Khor Ing Wei,
Dean's Office

When the National Medical Research Council (NMRC) awards were announced on 3 April 2019, the news that the Singapore Gastric Cancer Consortium (SGCC) was awarded a \$25 million Open Fund-Large Collaborative Grant was greeted with little surprise.

SCIENCE OF LIFE



Members of the SGCC team. Front row: Prof Patrick Tan from Duke-NUS Medical School, Assoc Prof Yeoh Khay Guan, Prof Yoshiaki Ito. Backrow: Dr Yong Wei Peng, Adj Prof Melissa Teo from the National Cancer Centre, Singapore, and Prof Jimmy So

The SGCC, which comprises scientists and clinicians from various disciplines who work on gastric cancer (GC), has already made considerable inroads in the scientific understanding, screening and prevention of the disease. The programme has also established large cohorts for studying GC and developed a blood test for early GC detection that is currently being marketed in Europe.

GC is the fifth most common cancer and the third leading cause of cancer death worldwide.¹ It is more prevalent in East Asia than other parts of the world, with 60 percent of new cases occurring there. In Singapore, it is responsible for nearly six per cent of deaths in men and women.²

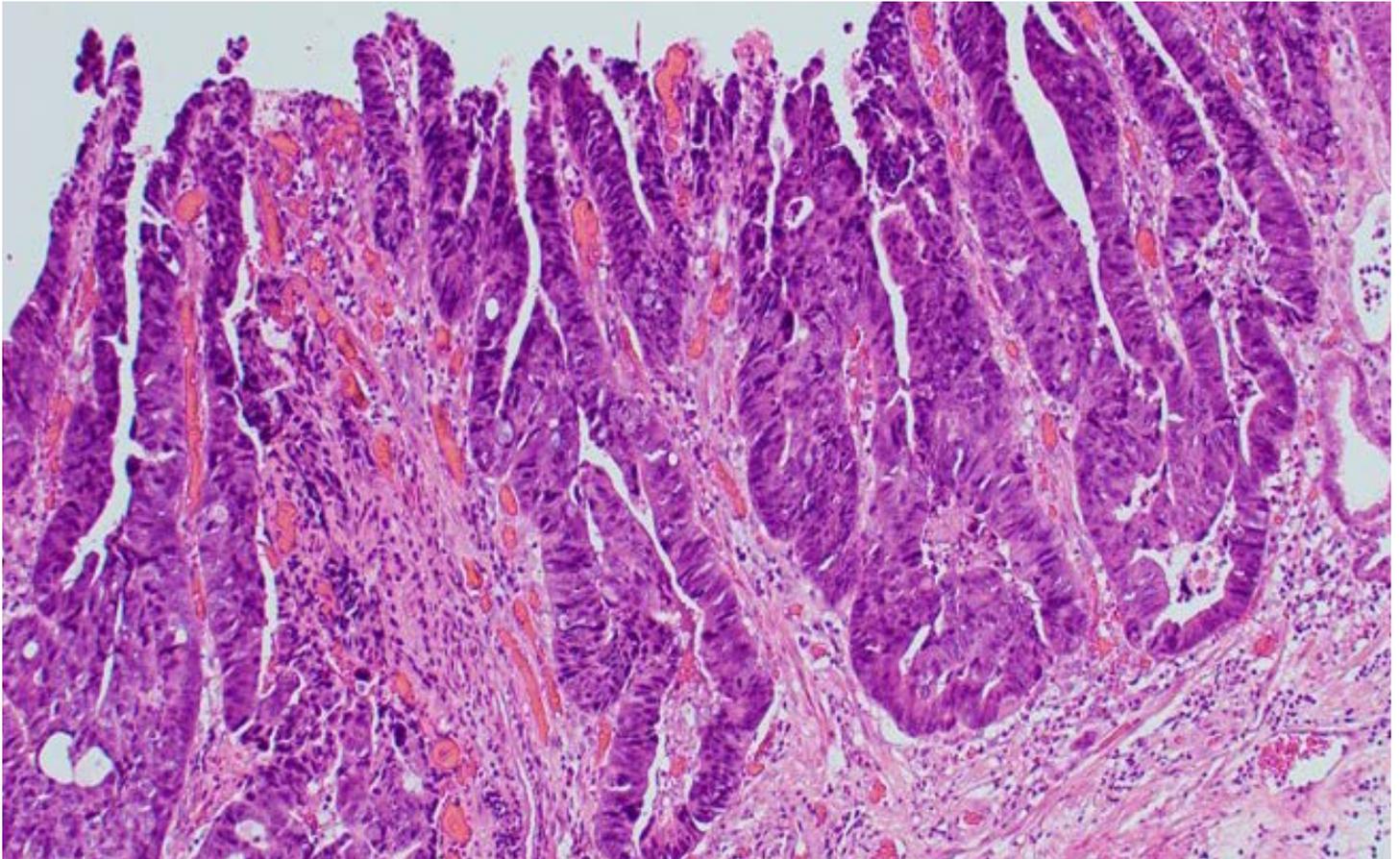
The high mortality rate associated with GC is due to the fact that the cancer is often diagnosed at a late stage, when effective treatment options are scarce. Early-stage GC is actually curable, either by removal of cancer cells during endoscopy or via “keyhole” surgery involving small incisions in the abdomen. If the cancer is detected and treated while it is still restricted to the stomach, five-year survival rates are approximately 70 per cent. Survival drops considerably (down to 5 to 30 per cent) for later-stage cancers that have spread to other sites beyond the stomach.³

Given these facts, one of the focuses of the SGCC programme is the early detection and prevention of GC.

The research team will continue to optimise the blood test for early GC (which detects small RNA tumour markers called microRNA), and evaluate the performance of a new genetic test for identifying patients infected with *Helicobacter pylori*, a major risk factor for GC. These efforts will help to stratify people who are at higher risk for GC, and who can then be followed up with endoscopy and more frequent monitoring. If cancer is detected, it can be treated with less invasive methods, with a relatively good prognosis. “This non-invasive blood test will greatly simplify the diagnosis of gastric cancer and allow for early intervention. Currently there is no reliable blood test for the diagnosis of gastric cancer. Our test, if approved, will be the first blood-based test for detection of gastric cancer in the world,” Associate Professor Yeoh Khay Guan told reporters recently.

Another research theme involves the development of precision GC therapies that target different forms of GC called molecular subtypes. After establishing three-dimensional cultures of GC cells (“gastric organoids”) with unique molecular subtypes, the research team will test the efficacy of various combinations of cancer treatments for the different GC subtypes represented by the organoids.

A particularly severe complication of GC is peritoneal carcinomatosis (PC), in which cancer cells spread from the stomach to the abdominal cavity. Untreated patients with



An image of GC cells

this condition have a terrible prognosis, surviving for only one to three months.^{4,5} Current treatments improve survival but, even with treatment, only 40 to 60 per cent of patients survive for one year.⁶

The third research area aims to address this problem by evaluating the clinical efficacy of a new delivery method, pressurised intraperitoneal aerosol chemotherapy (PIPAC). The PIPAC method delivers chemotherapy and immunotherapy to the abdominal cavity via an aerosolised spray, which could provide better coverage of the affected area.

Since developing new preventions and therapies for GC will hinge on having a better understanding of the disease, the programme will also focus on basic scientific research on the pathogenesis of GC. The fourth and fifth research themes will involve studying GC stem cells, which the SGCC researchers have already isolated and identified. The researchers will drill down to the level of a single stem cell and determine its genetic sequence. The idea is to characterise the molecular changes in the cells from which the cancer originates, and understand how these changes contribute to the heterogeneous gastric tumour and its response to cancer drugs.

Ultimately, the goal of the ambitious, multidisciplinary programme is to use the best anticancer weapons available to move the needle of survival for this deadly cancer.

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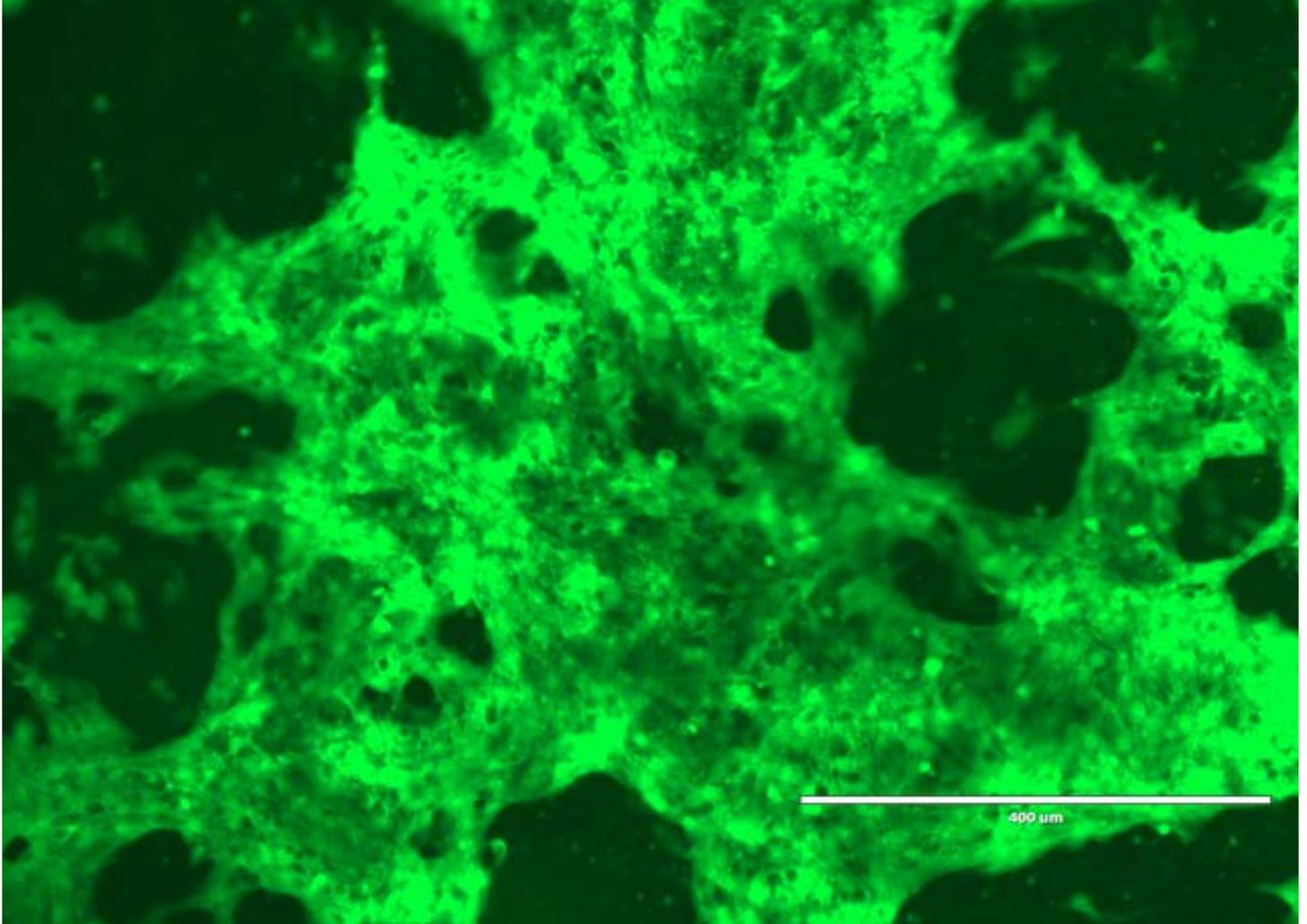


Figure 1: CRISPR-Cas9 gene editing was used to introduce a fluorescent reporter gene and a gene coding for myosin heavy chain 6 (MYH6) protein into pluripotent stem cells to track the insertion of the gene and the differentiation of stem cells into cardiomyocytes. Image Credit: Mr Mick Chang Jie LEE, a PhD student in Assoc Prof Roger Foo's group.

CRISPR'S WINDOW TO THE ORIGINS OF DISEASE

By Dr Khor Ing Wei
Dean's Office

Scientists have been modifying genes for decades to study their effects on biological processes. For most of this time, they had to use techniques that were laborious and not very efficient. This all changed in 2012, with the discovery that an obscure bacterial defense system, based on clustered regularly interspaced short palindromic repeats (CRISPR), could be turned into a precise, efficient and affordable tool to edit practically any genetic target.

Bacteria are thought to use CRISPR to remember and detect viruses that have infected them in the past. They do so by storing bits of genetic material from these viruses, akin to a memory bank of past enemies, in between CRISPR sequences. The bacteria also produce an RNA molecule that recognises each unique type of viral genetic material. Each RNA molecule, together with another smaller RNA, partners with an enzyme called a Cas nuclease to form a highly effective search-and-destroy team. When a virus from the memory bank is detected, the specific RNA molecule that recognises the virus' genetic

material will latch onto it, allowing Cas to cut it and stop it from becoming a new virus particle.

Scientists have fused the two RNA molecules together to form a guide RNA (gRNA) that directs Cas to a desired target.^{1,2} At one end of the gRNA is a spacer consisting of 20 bases (bases are the building blocks of DNA and RNA), which can be customised to bind to a desired genetic target. The other end of the gRNA binds to Cas, which cuts the target. Using this technology, genetic sequences as long as 10 kilobases can be removed and replaced with a desired sequence.³

Today, various CRISPR gene-editing kits are available for research and the technique is quickly replacing older methods such as site-directed mutagenesis, zinc finger nucleases and TALENS. Even non-scientists and schoolchildren are getting their hands wet, with a crowdfunding DIY CRISPR kit available for purchase in the U.S. (so far, it only works with bacteria).⁴

Here, we explore the gene editing research that is being performed at NUS Medicine, mostly using CRISPR and a form of the Cas enzyme called Cas9 (other Cas enzymes are also used around the world). This research ranges from deleting and swapping out genes to study their effects on disease processes, to developing innovative improvements to the CRISPR system.

Uncovering the mechanisms underlying diseases and treatment responses

One area where CRISPR is very useful is in generating “knockout” experimental models in which a gene or part of a gene is specifically removed and any biological changes that result from this are studied to determine the function of the gene or segment of the gene. In fact, the Transgenic and Gene Targeting Facility at the Cancer Science Institute (CSI) Singapore, headed by Dr Motomi Osato, routinely uses CRISPR-Cas9 to produce knockout models. The simple procedure involved in CRISPR gene editing enables these models to be produced in a matter of weeks, compared with the one to two years required by conventional knockout methods.

Professor H. Philip Koeffler at CSI Singapore used the CRISPR-Cas9 knockout model service at the core facility to help determine a new mechanism causing neutrophil-specific granule deficiency. In patients with this condition, the neutrophils fail to mature properly, leaving them susceptible to bacterial infections. From previous studies, the researchers knew that a protein called CCAAT/enhancer binding protein epsilon (CEBPE), was required for maturation of neutrophils and that the gene coding for CEBPE, *Cebpe*, was associated with neutrophil-specific granule deficiency. However, Prof Koeffler’s team did not know how the *Cebpe* gene was regulated. After analysing the DNA surrounding *Cebpe*, they found a gene segment with characteristics that made it a good candidate for a regulator of *Cebpe*.

Mr Yu Shuizhou and Mr Shi Jizhong at the Transgenic and Gene Targeting Facility produced a knockout model in which this gene segment, which they called the +6-kb enhancer, was selectively removed. In a paper published in *Blood*, Prof Koeffler and his team showed that deleting this enhancer reduced CEBPE levels and blocked the differentiation of neutrophils.⁵ Thus, using CRISPR gene editing, the researchers could determine that the novel enhancer played a role in blocking the differentiation of neutrophils, causing the neutrophil-specific granule deficiency condition.

Mapping the genetics and epigenetics of heart disease

Associate Professor Roger Foo, of the Department of Medicine at NUS Medicine and the National University Heart Centre Singapore, studies the molecular factors that drive the process of heart disease. Assoc Prof Foo is particularly interested in the epigenome, which refers to chemical compounds and proteins that attach to the DNA and regulate gene expression and function, such as turning a gene on or off.

Assoc Prof Foo and his team have made use of the targeting specificity of the CRISPR-Cas9 system to map out key epigenomic positions in the human heart. They are now planning to use CRISPR-Cas9 to edit the epigenome to figure out which parts are driving processes for heart disease. Once the researchers pinpoint the heart disease-relevant epigenetic changes, CRISPR-Cas9 may then be

used to selectively target these areas and potentially turn specific genes on or off to treat heart disease.

Besides using CRISPR-Cas to interrogate the epigenome, Assoc Prof Foo’s team is also applying the technology to study cardiomyocytes (heart muscle cells) and the mechanisms underlying heart disease. Cardiomyocytes are difficult to extract from humans and maintain in culture. Thus, researchers have found a way to persuade pluripotent stem cells to differentiate into cardiomyocytes in the lab. However, determining the efficiency of this process can be challenging. Dr Matias Autio, a senior research fellow in Assoc Prof Foo’s lab, has designed an elegant system using CRISPR to track the differentiation of pluripotent stem cells into cardiomyocytes.

This engineered CRISPR system inserts a sequence into stem cells that consists of a fluorescent reporter gene (cerulean) as well as the *MYH6* gene, which codes for the myosin heavy chain 6 (*MYH6*) protein. *MYH6* is involved in the contraction of heart muscle; its expression in stem cells, together with other conditions, induces their differentiation into cardiomyocytes. The cerulean reporter makes the cells glow green under the microscope, indicating that the inserted gene is expressed in the cells (Figure 1). The genes are designed such that, upon expression, the cerulean reporter protein breaks off from the *MYH6* protein, thus ensuring that the reporter protein does not affect the function of *MYH6*.

Dr Autio and his colleagues are also using CRISPR to make changes to specific nucleotide bases in genes that have been associated with heart failure. He then evaluates how cardiomyocyte function is affected by these genetic changes. This work could lead to a better understanding of the genes involved in heart diseases such as hypertrophic cardiomyopathy, in which cardiomyocytes enlarge, causing the walls of the heart to thicken and making it harder for the heart to pump blood efficiently. People with this condition may experience sudden heart attacks and death.

Making CRISPR better

Despite the power of CRISPR-Cas gene editing, the existing technology has several important limitations, including the requirement for a viral vector to deliver the guide RNA and Cas nuclease into cells. These vectors may provoke an immune response in humans, which would reduce their efficacy; they could also integrate into the host genome, causing damage or needlessly long-lasting expression. Another limitation of conventional CRISPR systems using viral vectors is that many do not work in primary cells, which are taken directly from an organism and do not multiply well when cultured in the lab.

The more Dr Volker Patzel, of the Department of Microbiology and Immunology, thought about these issues, the more he realised that the tiny DNA vectors he worked with could be better vehicles for delivering CRISPR components into cells. These dumbbell DNA vectors, so

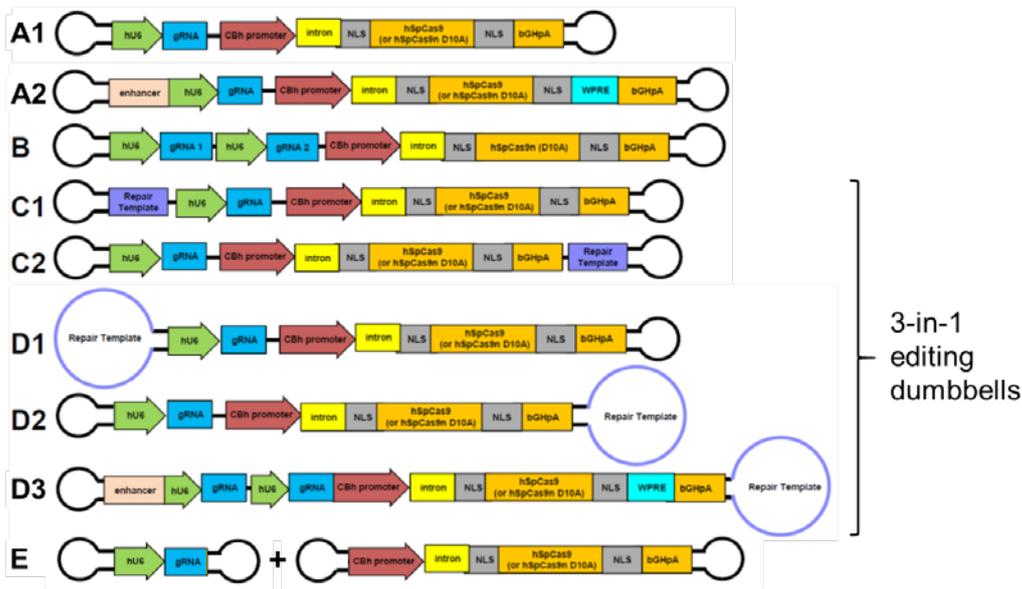


Figure 2: Different types of dumbbell vectors for introducing CRISPR-Cas components into the cell, including 3-in-1 vectors containing gRNA, Cas and repair template sequences. Image Credit: Dr Volker Patzel

named because of their shape, are the smallest genetic expression vectors available. Their small size, and especially their tiny diameters, enable them to efficiently enter cells and the nuclei of cells. Plus, the genes that they carry can be expressed in primary cells as well as cell lines. Dumbbell vectors can be designed to induce minimal or no immune response and are safer than viral vectors because they will not integrate into the host genome.

Dr Patzel, together with his PhD student, Avantika Ghosh, have generated many different types of dumbbell vectors carrying CRISPR-Cas components (Figure 2). One of these is a 3-in-1 platform incorporating the gRNA and Cas9 gene (or, alternatively, two gRNA and the gene for the Cas9 enzyme for improved target specificity), as well as a repair template that replaces one loop of the dumbbell.

When the 3-in-1 platform enters the nucleus, the gRNA and Cas9 enzyme will be expressed, forming a complex that specifically finds and cleaves the target sequence. Since the repair template is close at hand, the cell fills in the gap with a faithful reproduction of the template. Thus, the 3-in-1 CRISPR-Cas9 dumbbells are efficient, safe solutions for replacing specific genetic sequences, including repairing genetic mutations that are associated with disease. To facilitate the delivery of CRISPR-Cas9 through the nuclear membrane and to improve the gene-editing rates, some dumbbell vectors also incorporate signals that act like GPS locations, directing DNA to the nucleus (nuclear import signal) and Cas9 mRNA out of the nucleus (nuclear export signal), where it is translated to produce the Cas9 protein.

Another type of dumbbell vector that the team has developed comprises only the expression cassette for gRNA. They represent the smallest expression vectors in existence (as small as 130 base pairs), and can be finely tuned to enhance their delivery into cells. Such gRNA vectors could be used in cell lines expressing Cas9 to determine the functions of specific genes or can be combined with Cas9-expressing vectors to edit multiple targets or to optimise the amount of gRNA for efficient CRISPR gene editing.

Dr Patzel is also working on other ways to improve the usefulness and broaden the applications of the CRISPR-Cas dumbbells. For example, he and his collaborators are about to start testing the delivery of “naked” dumbbells through the skin, as well as the targeted delivery into the liver of dumbbells that have been modified with chemical moieties.

“CRISPR-Cas editing of primary cells still struggles with the lack of efficient and safe delivery vectors,” notes Dr Patzel. “Dumbbell vectors are non-integrating and not silenced in primary cells. Hence, they are most suitable to deliver the CRISPR-Cas editing technology; they do their job well and then disappear without a trace.”

CRISPR-based gene editing has come a long way in seven short years. As scientists improve the technology and address related ethical concerns, including its use in humans, and limitations, such as specificity, off-target effects and immunogenicity, it will continue to be a powerful tool for studying and treating disease.

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I drift like a cloud,
Across these venerable eastern lands,
A journey of unfathomable distances,
An endless scroll of experiences...
Lady Zhejiang, here we must part,
For the next province awaits my embrace.
Sad wanderer, once you conquer the East,
Where do you go?

By Tom Carter





Visit to the Leprosy Village

A CHINESE LESSON

By Yang Xinyi and Liew Xin Hui Sujata,
Phase III Medicine students

From April 18 to 29, a team of 15 students from National University of Singapore (NUS) embarked on a Study Trip for Engagement and EnRichment (STEER) to the south western region of China. Led by Dr Tan Lai Yong, the team comprised students from the Yong Loo Lin School of Medicine, Faculty of Dentistry, Faculty of Arts and Social Sciences – NUS Social Work and NUS Global Studies. The team traversed the region between Guangxi to Yunnan and obtained eye-opening exposure to Chinese healthcare, culture and society.



Bamboo Rafting



Hospital attachment at Guigang City's People Hospital

“ We were heartened to find the doctors at GCPH welcoming and nurturing, providing us with many opportunities to learn and patiently explaining their processes and ways of thinking to us. It gave us new insight into the work of surgeons and the medical context in China. ”

Medicine

Through the partnership between the National University Healthcare System (NUHS) and Guigang City People's Hospital (GCPH), the NUS team visited the hospital in Guigang city, Guangxi. The hospital had morphed over the course of a decade from a basic healthcare institution to a premier tertiary hospital. Previously a small county hospital, it currently has more than 2,000 beds and has developed technological capabilities to utilise 3D printing in orthopaedic surgery. Being the only tertiary healthcare institution in the city today, GCPH shoulders the Sisyphean task of meeting the healthcare needs of the city's five million inhabitants.

The two-day attachment at various departments at GCPH gave the Singaporean team opportunities to observe and learn about China's healthcare system. This allowed students to draw comparisons and contrasts between the healthcare systems of China and Singapore, and recognise the differing aspects of both systems.

What the team has observed in their two days in the city of Guigang is that society can function as a community as well. The large hospital grounds include accommodation for staff, and a shared cafeteria catering. Life was a bit more structured as many staff members live on the hospital grounds. The hospital organises team-building activities for the staff on a regular basis, such as soccer games and sports meets. The staff we had met were rather happy about their work life.

“China is still developing its primary care sector. There is still a lack of village and community level doctors. Many patients would also rather visit the tertiary hospital for basic care rather than go to their local community doctor. All these problems have caused the city hospitals to be overwhelmed with patients to the extent that patient beds commonly spill over to the corridors. Patients from outside the city actually make up more than those from the city.” said Phase II NUS Medicine student, Melvin Ng.



Visit to the TCM department of Yiliang First People's Hospital

“While some aspects may be different, the overall structure of patient management remains largely similar in both countries. It made me realise that although we may be educated in different countries and in different languages, the fundamentals of our knowledge is more or less the same.” added Marcus Kwok, also in the second year of his medical studies.

Additionally, the team had the privilege of interviewing Dr Darria Boubacar, a TCM professor in the Traditional Chinese Medicine (TCM) department of Yiliang First People's Hospital. They found Dr Darria, originally from Mali (Africa), a most interesting person.

Dr Darria's fluent Mandarin and expertise in TCM has transformed our impression of TCM. He empowered us to realise perspectives and that TCM and Western medicine are founded on very different fundamentals. Just because the workings of TCM cannot be simply explained with western science does not mean that there are no real benefits. As such, it is unfair to the patient to immediately dismiss the possibility of exploring TCM in his management.

People

The Singaporean students were also touched by the warmth of the GCPH's hospitality.

“We were heartened to find the doctors at GCPH welcoming and nurturing, providing us with many opportunities to learn and patiently explaining their processes and ways of thinking to us. It gave us new insight into the work of surgeons and the medical context in China. As GCPH continues to grow, we can look forward to an even closer collaboration between our two countries.” said Phase II NUS Medicine student Tan Wei Quan.

Culture

From GuiGang, the students took a 21-hour train ride to Li Jiang, where they were hosted by Madam Gao, a Naxi local woman who converted her 200 year-old traditional wooden home into a bed and breakfast for international student groups on cultural exchange visits. Naxi is the main ethnic group in Li Jiang. During the homestay, the team enjoyed relaxing evening strolls and experienced the community warmth of the Naxi people. Communal meals of dumplings and hotpot were prepared with the fresh produce grown in Madam Gao's garden. On one of the evenings, the team chanced upon a cultural dance practice session at a neighbour's home. Families and generations gathered to watch their children learn the traditional dance form that so eloquently expresses their cultural pride.



Madam Gao preparing dinner for the team

"This was an entire community's effort to pass on their Naxi culture and to bond with one another. It was an enlightening experience for me because I have never seen something similar before. At that moment, I realised how a culture can be easily lost within one generation should there be no resolution to actively preserve it. While it is regrettable that many Singaporeans have lost a significant part of their cultural identity, it is not too late for us to learn to protect our remaining culture more fervently." said Fion Tan, a Phase II NUS Medicine student.

Conclusion

As the Chinese saying goes, walking a million miles is better than reading a million books (读万卷书不如行万里路) The students went to China with a narrow perspective of its people, society and culture. However, in 12 days, the team returned with a newfound understanding, appreciation for and interest in the Chinese people and its vast and complex cultural and social landscape.



Photo taken at Yulong Xue Shan, Lijiang



Final year student Amanda Chia trying out the new VISE system

LIKE REAL!

Complex medical emergencies come to life through virtual reality simulation technology

Medical students at NUS Medicine put their knowledge and skills to the test as members of a medical emergency response team operating in various mass casualty incident scenarios, through a virtually simulated environment.

This is made possible through the School's introduction of the Virtual Interactive Simulation Environment (VISE) system at the Centre for Healthcare Simulation.

A part of the VR medical simulation project developed jointly by NUS Medicine and researchers from the Smart Systems Institute in NUS, this new supplementary learning system is native to NUS and Singapore. Beginning first with the development of the Virtual Interactive Human Anatomy (VIHA) three years ago, which enabled students to learn about human anatomy in great detail and depth, VISE is the next step forward in the application of VR technology for medical teaching and learning, said the School's Vice-Dean for Education, Associate Professor Lau Tang Ching.

A powerful learning tool

The three-dimensional, virtual casualty management system enhances the teaching and learning of situational patient management, added Centre director and Principal Investigator of the project, Associate Professor Suresh Pillai. "VISE lets multiple learners be immersed in various mass casualty situations where they experience high-resolution stereoscopic displays of realistic casualties in an authentic environment complete with multi-modal sensory and auditory stimuli."

"This new learning tool provides invaluable experience to our students, as mass casualty situations are laborious and costly to recreate in the real environment. But by harnessing the power of VR technology, they get to test learned skills and knowledge in mass casualty triage within a controlled environment, while gaining some appreciation for the complexities of operating as a team in a very demanding situation," added Assoc Prof Suresh. He is a senior consultant at the National University Hospital's Emergency Department.

In VISE, students don VR headsets and wield hand-held controllers to interact with each other in real-time as they manage multiple casualties. Their physical movements and actions are tracked and displayed in real-time



Assoc Prof Pillai (third from left) with KEIO-NUS CUTE Centre researchers Assoc Prof Yen Ching-Chiuan (far left) and Ms Teo Chor Guan (far right), and NUS Medicine final year students, Amanda Chia, Pearl Wee and Louiza Pittas.

for visualisation and evaluation. The students are able to conduct a host of assessments with the simulated casualties, including assessing and opening airways, evaluating breathing, assessing circulation by determining capillary refill time and pulse rate and assessing the physical disability status of the casualties. These actions underscore standardised and universally-practiced mass casualty triage protocols.

In order to ensure survival of as many casualties as possible in such situations, healthcare providers have to prioritise casualties according to the severity of their injuries. This process, known as triage, centres around making quick and effective decisions when the number of casualties outstrip available resources. VISE scenarios feature such casualties, challenging students to appreciate the dilemma faced by rescuers who must decide who can and should be saved in a major crisis.

Potential for more applications

The VISE system also features an in-built self-evaluation component that lets learners evaluate their actions, while also providing immediate feedback to learners on the accuracy of their actions. This was one of the major

considerations during the development of the system – that users become independent, self-motivated learners in keeping with the principles of Andragogy or Adult Learning. VISE’s carefully integrated elements thus ensure maximum interaction and feedback loops to ensure high student engagement.

“The initial feedback from pilot studies amongst medical students have been very encouraging and we believe that this sort of experiential learning is integral in helping to enhance and reinforce the didactic curriculum. VISE will not be limited to healthcare students but can be developed to include scenarios for more advanced healthcare practitioners. We also hope to extend the use of VISE to other healthcare providers, including the all-important pre-hospital personnel from the SCDF as well as military personnel from the SAF,” Assoc Prof Pillai said.

With the development of the first VISE system, there are plans for more scenarios to be progressively added to the module. Possible future scenario depictions include managing multiple casualties in an Emergency Room and Operating Theatre, as well managing Infectious Disease Pandemics.



WHO Health Assembly Regional Meeting

THE GLOBAL AGENDA ON UNIVERSAL HEALTH COVERAGE: TACKLING QUESTIONS OF QUALITY

By Dr Calvin WL Ho and Professor Vikki Entwistle
Centre for Biomedical Ethics,
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University of Singapore

The recent Lancet Global Health Commission on High Quality Health Systems emphasised that changing health needs, growing public expectations, and ambitious new health goals are raising the bar for health systems internationally.¹ The Commission also stressed that in the pursuit of better health outcomes and greater social value, “quality should not be the purview of the elite or an aspiration for some distant future”.¹ This reflects both a practical recognition that good quality healthcare is required to secure desired outcomes along with an ethical commitment to equity, fairness or justice.

In this article, we introduce some of the work that the Centre for Biomedical Ethics (CBmE) will undertake to help advance aspirations for high quality healthcare for all in the context of its role as a World Health Organisation (WHO) Collaborating Centre for Bioethics.

WHO’s Global Network on Bioethics

WHO Collaborating Centres (CCs) are key institutions sited in countries around the world that are recognised for their expertise needed to support the WHO in meeting its global health mandate. Singapore currently has 10 WHO CCs, including the Ministry of Manpower, Health Sciences Authority, Health Promotion Board, National Environment Agency and Public Utilities Board.

For bioethics, there are currently 11 WHO CCs, in countries from every continent except Antarctica. WHO CCs for Bioethics report primarily through the Global Health Ethics Unit of the WHO.

CBmE was first designated as a WHO Collaborating Centre for Bioethics in 2014, and was voted to chair the global network of WHO CCs for Bioethics in December 2018. As chair, we facilitate the development of several network activities, including the advancement of ethical guidance

relating to ageing, non-communicable diseases, big data and artificial intelligence, biobanking, preparedness in disease outbreaks, and Universal Health Coverage. We focus here on Universal Health Coverage (UHC), and introduce a project that aims to illuminate and help address the bioethical concerns relating to quality of care in this context.

Universal Health Coverage, quality of care and concerns about ethics

Since its establishment in 1948, WHO has advocated for everyone to have access to all necessary health services. The universal health coverage (UHC) initiative, anchored in the WHO Constitution and Right to Health, seeks broadly to ensure the availability of good quality healthcare for all people independent of their financial status. It encompasses services pertaining to health promotion, disease prevention, treatment, rehabilitation and palliative care.

Policy and health system leaders around the world can interpret and enact UHC with different emphases, and efforts to provide health services to all, however well intended, can raise a number of ethical concerns. Many of these relate to questions about which people, needs or services are prioritised (or not) and/or to various shortfalls in service quality and the distribution of these across different services or population groups.

Good quality healthcare remains elusive for many people across the world – even in some high income countries. The effectiveness of proffered interventions and the safety of services overall continue to be a major global concern. For example, a recent WHO report indicates that approximately 1 in 10 hospitalised patients experience harm as a result of their care, with at least 50 per cent preventability,² and concerns about safety deepen as healthcare environments become increasingly complex, pressurised and fast-moving. Shortfalls in the person-centredness of healthcare provision also continue to be reported in many services. These include

Previous WHO work done in relation to the ethical aspects of UHC

The WHO report, *"Making fair choices on the path to universal health coverage (2014)"*, offers guidance to countries as they consider how to allocate resources across the different kinds of healthcare interventions or services they might want to fund. It recommends a three-part strategy of (1) categorising interventions or services into priority classes, (2) expanding coverage of high priority services for everyone and (3) while doing so ensuring that disadvantaged groups are not left behind. While this guidance has been welcomed and experienced as helpful in some contexts, it was, for practical reasons, quite narrowly focused and left many important issues, including some key aspects of social fairness or equity in healthcare provision, open for future deliberation and development.

The WHO policy brief *Anchoring universal health coverage in the right to health: what difference would it make (2015)* recognised the ambiguity that can arise from different interpretations of the concept of UHC. It considered UHC in relation to promotion of the human right to health, and drew attention on that basis to the need to attend to forms of exclusion from health care that can arise from discrimination made on grounds other than financial ones. The brief called for more attention to vulnerable and marginalised groups.

The report of a WHO meeting in Tübingen, Germany – *"Developing an ethical framework for healthy ageing (2017b)"* is relevant because it recognises that problems can arise when medical care is organised and assessed with a stress on disease-related goals and outcomes (p15-16), and when 'coverage' of care provision is achieved only across segregated services (p18). It also follows the WHO 2015 report in reflecting a concern for social justice that goes beyond basic distributional concerns.

The WHO report, *"Universal Health Coverage: Moving Towards Better Health (2016)"*, provides an action framework for countries in the Western Pacific region of WHO to help accelerate progress towards access to quality health services for all. As the report explains, the quality and safety of health services delivered at individual and population levels are fundamental to improving population health. WHO member states face barriers to quality and safety, leading to overuse, underuse or misuse of services and resources. The report considers how these issues can be addressed in practical terms by strengthening regulations and the regulatory environment, developing effective and responsive individual and population-based systems and services, and engaging individuals, families and communities. It mentions a need to ensure health professionals are ethically competent but does not discuss further engage in explicit discussion of ethical issues.

instances of healthcare staff or systems treating patients with a stark lack of respect or compassion, or failing to accommodate their particular needs and values. When quality shortfalls are disproportionately experienced among those who are already disadvantaged, additional concerns about fairness arise. These are perhaps particularly troubling in the context of the pursuit of UHC.

It is important to recognise that efforts to regulate and improve the quality of health services can themselves raise ethical concerns, for example about how responsibilities are allocated and how healthcare employees are treated in efforts to improve patient safety, and about how drives to improve efficiency might work against efforts to improve person-centredness or fairness.

Previous WHO work has made several important contributions to thinking about ethics in the provision of UHC, in particular regarding decision-making and priority setting (see previous page). But some of the other ethical concerns mentioned above have not yet been adequately

the initiative will focus at least to some extent on primary health care contexts.

A key early aspect of the work will bring an international expert meeting of bioethicists, relevant WHO technical specialists and regional leads, and other international, regional and local health policy/system leaders to Singapore in the last quarter of 2019. The meeting will include presentations and discussions on ethical concerns associated with the quality of healthcare, including both: (a) insights 'from the field' (from a diverse selection of countries), examples of problems or concerns relating to quality and ethics in the pursuit of UHC, and a sense of whether and how these are currently dealt with; and (b) conceptual/theoretical work on ethical principles and quality norms, and ideas about how these can be made practically useful for health system development.

Following the meeting, CBmE and GHEU will lead the iterative drafting, review and refinement of the guidance resource.

“ It is important to recognise that efforts to regulate and improve the quality of health services can themselves raise ethical concerns... ”

addressed. Dr Tedros Adhahanom Ghebreyesus, the current Director General of WHO, recently reiterated that the “key question of UHC is essentially an ethical one”, and the WHO’s current general programme of work makes clear that WHO is committed to ensure that policy makers and health implementers at both international and national levels keep ethics at the heart of their decision-making. The work CBmE contributes to is consistent with this commitment.

Towards practical guidance on quality as an ethical imperative in UHC

CBmE is leading a collaborative initiative with the Global Health Ethics Unit of the WHO and members of the global network of WHO CCs for bioethics to develop practically useful guidance to support health policy and system leaders to consider quality of care (broadly construed) as an ethical imperative as they strive for UHC and health for all. We currently anticipate that the ethical issues of interest will include values associated with person-centred care and socio-relational aspects of equity, and

Opportunities to participate in the international expert meeting are by invitation only, to ensure diverse domain expertise and geographic representation. If you are interested to learn more, please contact the authors, Dr Calvin Ho or Professor Vikki Entwistle, co-chairs for CBmE of the WHO network of collaborating centres for bioethics.

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REFLECTIONS OF A WEEKEND GARDENER

By Dr Noreen Chan,
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Singapore (NCIS)

My late father had many interests and pursued each with alarming enthusiasm. Alarming mainly for my mother who constantly fretted when he was off on one of his shopping forays, never knowing what he would return with. The antique porcelain urinal was still manageable, but the blackwood opium bed presented some storage problems. His everlasting passion though, was gardening. Even in his later years when walking was difficult, he would find a way to spend time among his fruit trees and orchids.

He would go to the trouble of assembling his own “personal protective equipment” (raincoat, mask, gloves, boots) when spraying his plants, and when it became difficult to buy certain fungicides and pesticides in Singapore, he would drive up to Malaysia to stock up. It seems incredible now when I think about what chemicals we had stashed in

his workshop or garden shed, but then again, he used to keep bottles of ether in the stationery cupboard (for dental anaesthesia).

As one of the younger (and more compliant) children, I often had to help him out with chores like watering the plants, often with great reluctance because of the heat and mosquitoes. As well as the smell from fertilisers like blood and bone, or fish emulsion (which drove the cats crazy). He would weed here, trim there, point out particular plant species, expound on the benefits of chicken dung, and I would wish I could be indoors watching TV.

And yet, after he died and the house was sold and we moved to an apartment, I insisted we have a balcony so that we could have plants. I paid almost \$1,000 for a plant stand, recalling Pa’s advice and asking for a hardwood like chengai – “it will last for 20 years” – and as my initial efforts produced a long list of dead plants, regretted not paying more attention to what he had said and done.

But over time, as I put into practice what he had told me, and by a combination of trial and error, and luck, I now come home to a nice bit of greenery on my balcony. But my working hours being what they are, the only time I can devote proper attention to the plants is over the weekend. I have missed many moments of the kheng hwa



plants which bloom for one day only, as well as catching attacks of caterpillars or mealy bugs. But I have also experienced the thrill of watching a “once a year” orchid unfurl its showy blooms.

“ The garden suggests there might be a place where we can meet nature halfway. ”
– Michael Pollan

There is something enduring and therapeutic about gardens and gardening. Once humans had learnt to domesticate wild plants, they started to create gardens, growing plants not only for food and medicine, but also for enjoyment and pleasure. Gardens all over the world are products of their time, reflecting local geography, aesthetics, philosophy and even religion. You may not understand what a Japanese Zen garden is about – the carefully raked sand, the artfully placed stones – but you have to admit there is something deep and ineffable about it.

Lee Kuan Yew is remembered for many things, but in my view, one of his greatest achievements was to encourage tree planting and greening of our island city state. We Singaporeans take it for granted that we can look out our windows and see greenery, but if you have ever lived in cities that were literally concrete jungles, you will appreciate how restorative it is to see, and be close to, trees and plants.

The presence of greenery is not just aesthetically pleasing, it has real impact on the ambient temperature and air quality of urban communities. Gardens also have therapeutic benefits for patients of all ages, from terminally ill children to elderly people with dementia. The late Oliver Sacks, who spent his career treating people with chronic neurological diseases, attested to *The Healing Power of Gardens* (<https://www.nytimes.com/2019/04/18/opinion/sunday/oliver-sacks-gardens.html>) not only for his patients, but for himself.

I draw many parallels between planting orchids and education and training. Take repotting, a necessary activity when the plant outgrows the pot; when it comes to orchids it could seem a fairly brutal process. My father would insist that the old roots had to be cut away almost to nothing, then he would subdivide the old plant into two or three. Next, he would anchor each plant firmly in fresh charcoal, before placing them in a shaded part of the garden. He explained that the dense mass of old roots and the old growing medium, was choking the plant so it could no longer grow well. We would not know for weeks whether the re-potted plants would survive, let alone thrive; we could only tend them carefully and be patient.

There are many parallels to teaching (especially higher training): “old roots” or old habits may need to be pruned before new growth can occur. But at the same time, the young plant needs strong support, nourishment and a protected environment so it can grow roots of its own. You

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can do the same thing for a hundred “seedlings” but the outcome will not be the same for all; if you’re reasonably skilled and lucky, most if not all will survive, and if you are very lucky, a few will be not only robust but outstanding. And even those we consider irritating, have their place and purpose, in the words of American columnist Doug Larson, “A weed is a plant that has mastered every survival skill except for learning how to grow in rows.”

“ Help us to be ever faithful gardeners of the spirit, who know that without darkness nothing comes to birth, and without light nothing flowers.

- May Sarton

Everyone has their weekend activities, mine happens to involve pottering around my balcony garden, for the simple reason that I enjoy growing things. Even experimenting by planting seeds of chilli, pomelo and bittergourd bought for consumption, just to see what happens. If nothing else, it has made me appreciate what it takes to coax fruits and vegetables from the earth.

But it is more than that. Simply put, being in a garden, close to nature, replenishes my spirit. I think it was like that for my father as well, over and above the satisfaction derived from a bountiful fruit harvest, or a profusion of colourful blooms. It gave him joy, even as age and illness were taking so much from him . That kind of connection to something or someone that is healing is what we all need, and many do not even know they yearn for it.

This need becomes more obvious and urgent during serious illness, and towards the end of life, but really, we all have spiritual needs throughout our life stages. And just as we work to “top up” and “maintain” our physical and financial accounts, we need to attend to our “spiritual back accounts” too, because one day we will need to consider how we will “Leave Well”, which is hard if we have never considered what it is like to “Live Well”.

If nothing else, understand yourself, and live authentically. My father certainly did, and unapologetically too. I did not agree with all his life choices, but I respected his grit and tenacity, his generosity and curiosity. During his wake, we saw the threads of his life coming together – his old Scout friends in various stages of frailty, our large extended family, former colleagues, the pump attendant from the petrol station down the road – and they spoke of a man who lived fully and without prejudice.

It has been 10 years, but I am often reminded of him, especially when I am in my garden, or indeed any garden. Pa, wherever you are – I was right about composting (yes you can do it on a balcony without mess), but you were right about everything else.

Noreen Chan
May 2019



The author's father in his garden

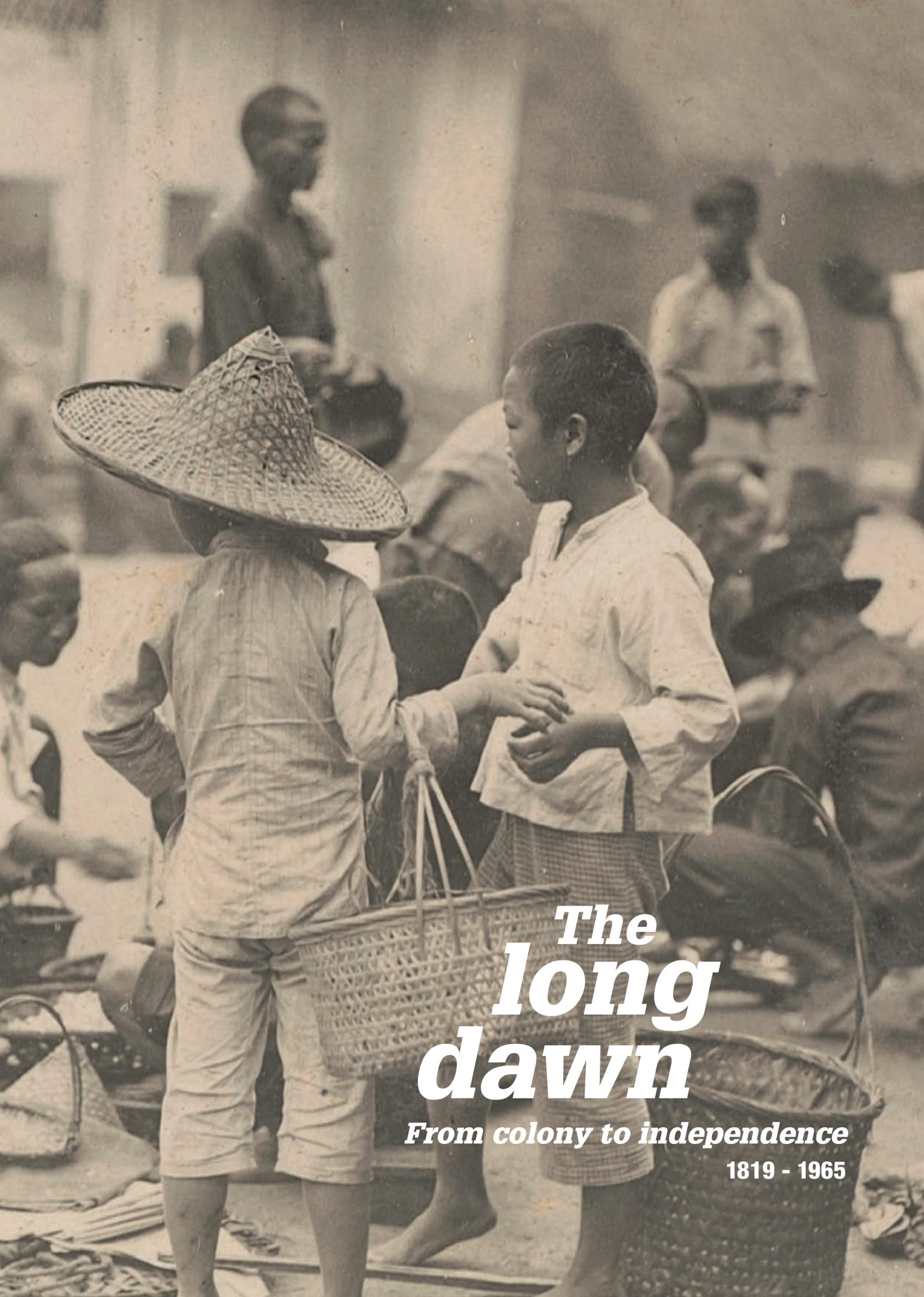
One Vast Garden

“I find one vast garden spread out all over the universe. All plants, all human beings, all higher mind bodies are about in this garden in various ways , each has his own uniqueness and beauty. Their presence and variety give me great delight. Every one of you adds with his special feature to the glory of the garden.”

By Sri Anandamayi Ma



Grocery shopping in the 1930s... public hygiene, and its effect on health, were not major factors in the Singapore of that era.



The
long
dawn

From colony to independence

1819 - 1965



Early days... Singapore in the early 1800s was a fishing ▲ village with barely 1,000 people.

The

birth of modern Singapore as we know it now is inextricably linked to the arrival of Sir Stamford Raffles on 28 January, 1819.

It was not an easy beginning. Singapore then was little more than a fishing village, mostly covered by jungle and a few buildings, a few acres of land under cultivation. It had a population of about 1,000 – about 500 Orang Kallang, 200 Orang Seletar, 150 Orang Gelam and other Orang Laut, 20 to 30 Malays and about the same number of Chinese. But Raffles moved fast. Within days of landing, he had concluded the Singapore Treaty with the local rulers to secure rights for a British trading post in Singapore. By 1824, Singapore and its surrounding islands had been ceded to the British East India Company and subsumed under the rule of the Straits Settlement government, founded in 1786 by Sir Francis Light and based in Penang at that time.

In Raffles' retinue in 1819 was a detachment of European and Indian troops and their accompanying doctor, young sub-assistant surgeon Thomas Prendergast. By most accounts, western medicine is said to have arrived in Singapore in the person of Prendergast, given his responsibility for the health of the expedition.

True to Raffles' vision, Singapore grew rapidly. Western medical care in the early decades of Singapore's founding was administered by doctors in military hospitals for the troops. Local inhabitants and immigrants sought treatment from their traditional doctors and healers. Prendergast, as the military doctor for the troops, was put in charge of the first General Hospital. This was the predecessor of today's Singapore General Hospital (but little more than a shed then) erected near the junction of Bras Basah Road and Stamford Road in 1821.

Medical services were also strictly segregated along economic and social status, a result of prevailing discrimination. The General Hospital was the preserve of European soldiers, sepoy (Indian soldiers) and the colonial government. The medical staff was made up of military doctors, consisting of an assistant surgeon and an assistant apothecary, assisted by a few medical subordinates. Nursing, if it could be called that, was usually the work of convicts, who clanked around the wards in their chains.

Government officials and the European community were luckier. They were treated in their homes by surgeons sent from the General Hospital. If they were very ill, they were treated in the homes of

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the surgeons. But in the early years, there was no hospital for civilians such as sailors who were not part of the colonial military establishment. Nor was there one for the local inhabitants.

At the time, diseases such as cholera, smallpox, enteric fevers, typhoid and venereal diseases were common. And treatment was rudimentary at best: Hospitals were often dilapidated, had few beds and suffered from chronic shortage of trained staff. Medical officers were posted from India, the seat of the colonial government, and since Singapore was then regarded as a backwater, such postings were dreaded as hardship assignments. Not surprisingly, few came willingly.

Even for the elites, a stay at the General Hospital was fraught with its own dangers. In addition to less than sanitary conditions, a shortage of staff meant convicts were pressed into service as nurses, orderlies and dressers. As one diary entry described it: "The local convicts are invariably in chains, the clanking of the irons about the ward is sometimes severely felt by the weak and seriously indisposed patients."

It was not until 1821 that the local inhabitants and immigrants got their own hospitals, or more accurately, buildings being used as hospitals. And even so, the names of these hospitals reflected the prevailing convention of the day. They were known as hospitals for natives, convicts or paupers, or for the mentally ill, lunatic asylums.

Under these conditions, necessity being the mother of invention, private medical care found a

foothold. Records showed that two enterprising European doctors set up their own private hospitals in the 1820s but, as charges were high, only the well-heeled could afford them.

As trade passing through the port continued to grow, so did the number of Europeans, sailors, coolies and immigrants from the surrounding countries. This, in turn, led to growing demand for healthcare. Senior hospital administrators, struggling to cope with demand amidst poor conditions, kept highlighting the deplorable state of healthcare for the growing civilian population to the colonial government. However, the latter, based in faraway Bengal in India repeatedly rejected proposals to build a general hospital for Europeans and sailors.

Ships' captains were especially vocal in their demand for medical services for sick crew members whom they brought ashore for treatment. The captains often rented houses where they could treat their sick crew members, sometimes even leaving them behind when the ships continued on their voyage.

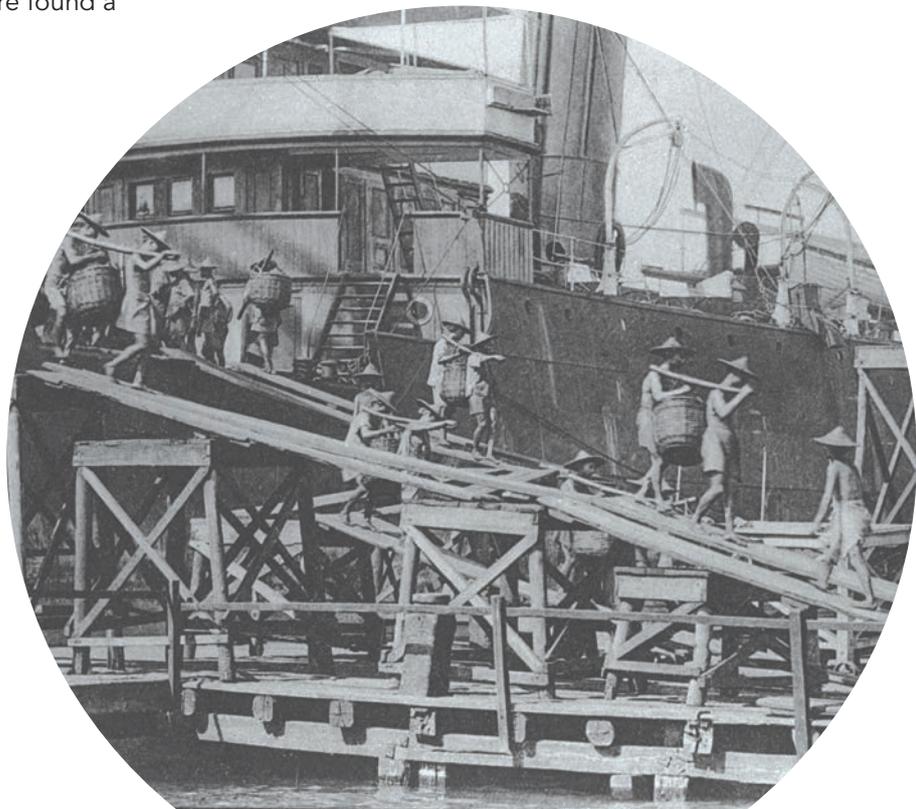
The general hospitals have a colourful history of

▼ Trading places... as trade grew and more ships docked at Singapore, the captains of the vessels started seeking medical treatment for crew members who were unwell or injured.

1821



The first General Hospital was erected near the junction of Bras Basah Road and Stamford Road. It wasn't much more than a shed at that time





Desperate place... poverty, destitution and beggars were common in the early 1900s. ▲

their own. According to the Straits Settlements records, the shed that stood as the first General Hospital in 1821 was replaced by a second in 1822 but the latter "fell down" in February 1827 "on account of the decay of the temporary materials with which it was originally constructed". A directive to build a new hospital "with every regard to economy" was issued. This was apparently obeyed to the letter because the new hospital was in a state of disrepair by 1830, barely two years after it opened. It was described as dilapidated and full of holes, impossible to stay at when it rained and was eventually abandoned.

In 1831, the new Assistant Surgeon, Dr Thomas Oxley, arrived and proposed that a new general hospital for Europeans and locals be built. But it was not until 15 March 1843 that the colonial government, which regarded Singapore as a financial burden and kept a tight lid on its budget, sanctioned the building of the fourth general hospital. Called the Seamen's Hospital, it was built at Pearl's Hill and opened in 1845.

A decade later, a fifth move would take the General Hospital to the Kandang Kerbau district. Its given name, reflecting the patients it served, was the European Seamen's and Police Hospital; it also took in female patients for gynaecological issues from 1865.

An outbreak of cholera in the area in 1873 forced a temporary move to Sepoy Lines. What was intended as a temporary site became its permanent home when the sixth General Hospital was built and opened in 1882. The site at Outram Road was deemed ideal – on a hill and open to the prevailing breezes, with good drainage and water supply, and near town.

Around the mid-1880s, Singapore was also looking to add female nurses to its healthcare workforce. Despite requests as early as in 1856, when the hospitals were beginning to take in female patients, it was only in January 1867 that approval was granted by the colonial administration. Singapore's first female nurse had an onerous workload, working in the lunatic asylum while

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also attending to patients in the nearby General Hospital. For all this, she was paid 22 rupees a month. (Rupees and Spanish dollars were both legal tender at the time. The rate of exchange was roughly two rupees to a dollar.)

However it would not be until 1 August 1885, the day when nuns from the local French convent began to care for the sick in the General Hospital in Sepoy Lines, that nursing really made its presence felt. For that reason, Singapore celebrates Nurses' Day on 1 August each year and exemplary nurses receive the prestigious President's Award from Singapore's head of state.

Medical services for natives, convicts and lunatics

The Singapore of the early decades was a desperate place. Graphic descriptions in the Singapore Free Press and the then newly-founded The Straits Times painted a picture of poverty, destitution, beggars on the streets, petty crime and opium addiction, among other social ills.

Immigrants flocked here in search of jobs and a better life. Many of them found themselves penniless and jobless, victims of illness and disease. Many turned to crime to support themselves, and to opium for solace.

1882



After a subsequent succession of moves, the General Hospital found a home at Sepoy Lines, its present location at Outram Road

In June 1821, the first Pauper Hospital was opened in the cantonment. Funds to operate the hospital were low, as the Governor refused to raise the budget to run the hospital. He felt the Chinese community should help pay for treating their own, especially the poor, since the beggars among them represented a growing social problem.

Without contributions forthcoming to keep it running, the hospital was ordered closed. A stay of execution came in the form of the Pork Farm Tax. As the Chinese community was the major consumer of pork, the monopoly of slaughtering pigs and selling pork was auctioned off and revenue from it was used to run the hospital. But the tax was abolished in 1837 on the order of the Governor-General of the Straits Settlements who

▼ Smoke screen... the use of opium to overcome hardships led to addiction which, in turn, added to the many social ills.



INSIGHTS

► Nun left behind... in 1885, the Principal Civil Medical Officer wrote a letter (below) to the Lady Superior of the local French Convent, permitting French nuns (right) to start work in the General Hospital.



Office of Principal Civil Medical Officer,
Straits Settlements.
SINGAPORE, 28 July 1885

Madaam
I have the honor to inform
you that all arrangements will be
completed for the accommodation of
the nurses at the Le Roy Lines Hospital
on Saturday the 1st proximo, and I shall
feel obliged if you will be good enough
to give instructions so that they may
take up their duties from that date.

I am
- Madaam
Your most obed^t servant
J. J. J. J. J.
Principal Civil Medical Officer

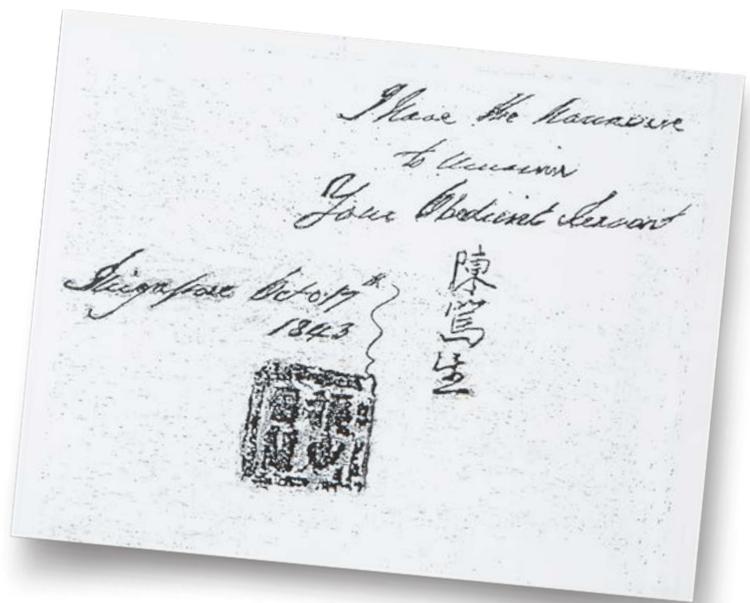
The Lady Superior
of the Convent

was based in India and unfamiliar with the situation on the ground in Singapore. Very soon, the ill and sick, beggars and vagrants began to fill the streets again.

The problem was compounded by increasing arrivals from China due to political upheavals there, as well as sick Chinese labourers from the Dutch colonies who were secretly dumped from their ships at night.

An editorial in the The Straits Times of 23 September 1845 described the situation thus: "It is now more than 25 years since the first formation of the Settlement of Singapore, but still up to this hour no provision is made for the poor, asylum for the sick, no refuge for the destitute. The increase of crime is dilated on, its growing evil lamented but no eye pities, no hand is outstretched to help the poor."

It goes on: "Most of the streets, bridges, passages of the Town and place of public resort are thronged with miserable objects whose diseased



▲ Signed, sealed and delivered... in 1843, wealthy Hokkien merchant Tan Tock Sing (his name was changed to Seng in the 1950s) pledged \$5,000 for a hospital to cater to the local Chinese population via a letter (above) bearing his signature and stamp.

Chan Sang in some records) in his will soon after Tan's donation.

As a result of these efforts, the foundation stone for the Pauper Hospital was laid on 25 July 1844 in Pearl's Hill, just days after the nearby Seamen's Hospital (the fourth General Hospital) got its own foundation stone. As Tan Tock Sing declared, in his letter officially handing over the Pauper Hospital building to the colonial government dated 21 March 1846, it was intended "for the reception and relief of sick, destitute, diseased and decrepit persons of all classes in Singapore who are unable to earn a livelihood or to obtain the means of subsistence except by public begging in the streets". The building was ready in 1847.

It is noteworthy that Tan Tock Sing and his fellow philanthropists did not exclude anyone in need from admission to the Pauper Hospital, which the locals called Tan Tock Sing's Hospital (from the 1950s, it was referred to as Tan Tock Seng Hospital). However, while Tan provided the bulk of the money to build the hospital, a shortage of funds meant it could not operate and paupers were still housed in a rickety shed at the foot of Pearl's Hill until Mother Nature played her part. The shed was destroyed by a violent storm, forcing the move into the Pauper Hospital premises in October 1849.

It is also interesting to note from Tan Tock Sing's letters to the government that the hospital was intended to keep vagrants off the streets, not solely for the sick. The government contributed

and shattered frames strike horror to the heart... their forlorn situation is no crime... no fund exists from whence their necessities may be relieved and the evil complained of remedied."

The Straits Times also stated that, of the 36,000 Chinese inhabitants in Singapore, about one third had no visible means of support. It quoted police figures to show that nearly 6,000 were close to starvation, with more than 100 succumbing to it each year.

Still the government felt that the Chinese should take care of their own. In 1843, a wealthy Hokkien merchant, land owner, entrepreneur and philanthropist named Tan Tock Sing (modern day usage spells it as "Seng") offered to donate \$5,000 to the construction of the new Pauper Hospital. When approached for his views on the matter, he pledged the sum in a historic letter to Lt Colonel Butterworth, CB, then governor of Prince of Wales Island (Penang), Singapore and Malacca. Various sums were also pledged by other Chinese, among them 2,000 Spanish dollars bequeathed by the wealthy Chan Cheng San (also known as Cham

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Mix of people... cultural and language differences among the people in early Singapore made it tough for doctors to do their job. ▲

medicines but not funds and there was no concerted effort to fight the prevalent diseases of the day, such as fevers, dysentery, malaria, smallpox, rheumatism, venereal disease and tuberculosis.

It would take the vision and generosity of other early pioneers like Tan Kim Ching, Tan Teck Guan (the son and grandson of Tan Tock Sing respectively), Tan Jiak Kim (unrelated to Tan Tock Sing), Wee Boon Teck and Loke Yew to use their influence and financial support to build more hospitals for the natives in later years.

While the number of hospitals grew slowly, and their sturdiness to withstand the elements improved, early hospital administrators wrestled

with the problem of finding medical expertise and staff. Economy was the watchword of the day. Even the General Hospital, the preserve of the colonial administration, was run on a very tight budget. According to the Straits Settlement records of 1866, it used old bed sheets as bath towels until August that year when permission was given for the purchase of "four dozen bathing towels at a cost not exceeding \$20". In the hospitals for the natives, patients were allowed to wear their own clothing but the condition of their clothes was often "in so bad a state from dirt so as to be detrimental to their recovery". Treatment costs had to be raised from 10.5 cents per day to 16 cents in November 1866 to raise money to supply patients with clothing and bedding.

Early Singapore's first doctors faced their share of

INSIGHTS

problems too. Many of them were posted from Britain and India, often military doctors who arrived with their regiments, and they grappled with issues of cultural and language differences.

The doctors found many strange tongues, habits and customs among their patients. Not only did the Chinese speak many different dialects, the Malays, Siamese, Burmese, Bugis, Javanese, Arabs and many more immigrants added to the mix of languages.

However, despite more doctors arriving, the shortage of medical personnel continued due to the increase in population. With growing numbers of people came diseases. Cholera, smallpox and dysentery outbreaks were common, as was tuberculosis. Vagrants, beggars and the sick lined the streets, with no right to seek treatment at the general hospitals and too poor to pay for their native services. This led to growing calls to train locals to ensure adequate medical workers.

Early medical education in the colonies

Until 1832, the Medical Department for the Straits Settlement was based in Penang, the capital. When the capital moved to Singapore in 1832, the Medical Department followed in 1835.

Medical services were rudimentary at best. Although there was a Senior Surgeon in Penang, he was assisted by medical subordinates, who functioned as military and civil medical officers. Often, the Governor had to order military doctors to attend to patients in civil hospitals.

A 1978 book titled *The Medical History of Early Singapore* repeatedly mentioned the constant shortage of medical staff. To alleviate the problem, a proposal was put up to train selected local boys as medical assistants, or apothecaries. But the pay was low and the work very demanding.

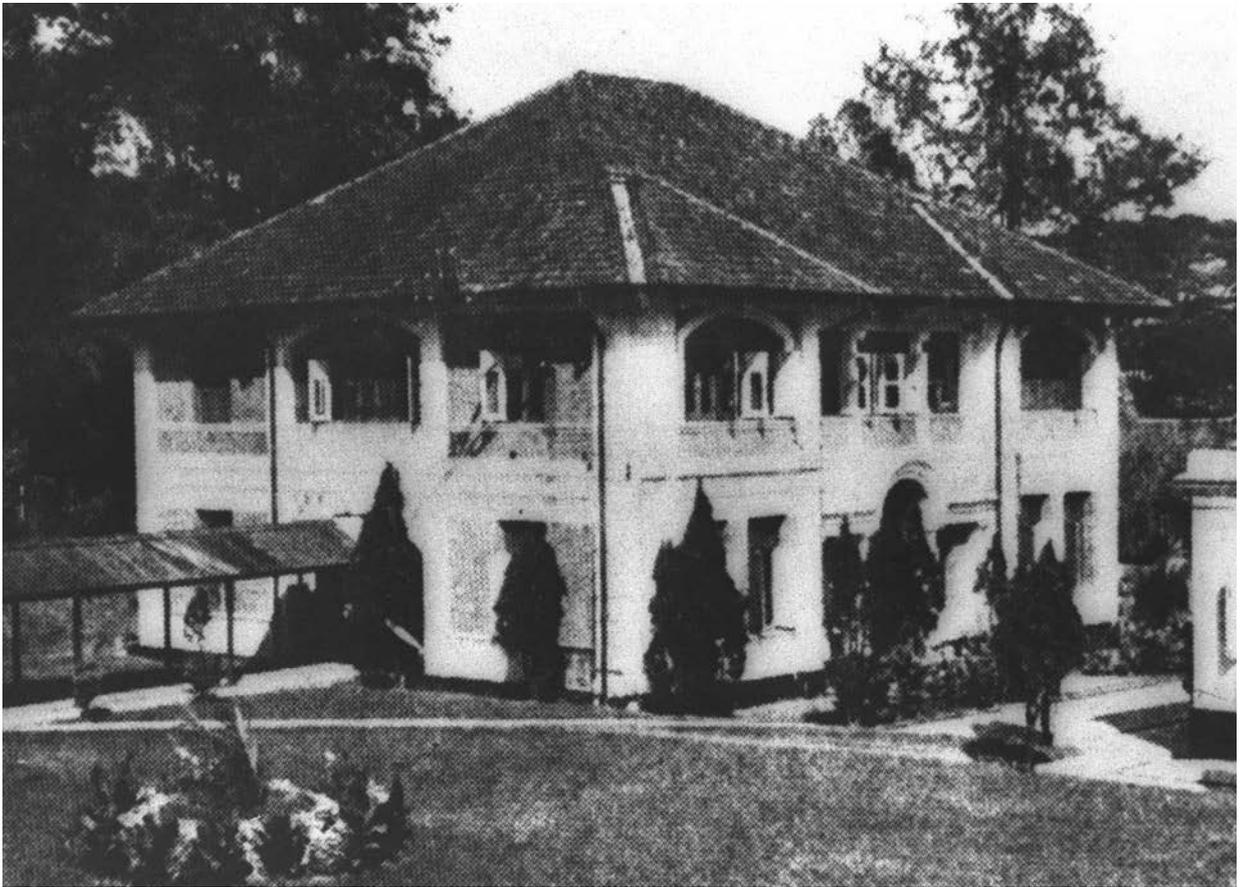
When the Senior Surgeon in 1822 submitted a plan to the Governor to train selected students from the Penang Free School as apprentices, with a five-year bond, the proposed salary was \$6 per month while undergoing tuition. When they were qualified to perform their duties as apprentice apothecaries, they were paid \$10 per month. To compound matters, the training was so hard

that, of the four original trainees, one dropped out and one ran away. In 1825, the remaining two qualified and received a 50 percent pay rise... to \$15 per month!

Not surprisingly, it was hard to get potential trainees to enrol. An excerpt from *The Medical History of Early Singapore* detailing the duties of an assistant apothecary is self explanatory: "He is placed in charge of the medicines at the Convict Hospital, from which the Native Pauper Hospital, Lunatic Asylum and Jails are also supplied. He has to attend to the Surgeon when he visits the Hospitals, take down notes of any important case, register the prescriptions, see to the medicines compounded, superintend the Dressers, register the names etc. of all the patients who come to hospital, enter their details and draw out returns for them all. Lastly, he must be a person who is able to maintain strict discipline in the hospitals, which is sometimes no easy matter, particularly in the Convict Hospitals."

A midwife's birth report made to the Director of Medical Services or Tokubetu Si in 1946. It still referred to Singapore as "Syonan-to" despite an official ban by the British Military Administration on the name in October 1945 after the Japanese Occupation ended.

MED IM No 3900
The Director of Medical Services.
Tokubetu Si
Syonan-to 16/9/46
Report of Birth by the Midwife
I hereby give notice of the following birth
Address 14, Klang Rd. Spore
Father's Name N. Palani velu
Place of Confinement 14, Klang Rd
Nationality Indian Sex Male
Date & Time of Birth 12-20/Jan 16/3
The child was ^{live} born Live
Signature Thomas W. Carey
Address 2, Secker Rd.
Class A
" B
" C
J. 984-10/04.



Nor was medicine then an attractive career path. The treatment of medical officers, as described in the book, was shabby, with "no organised teaching, no promotion prospects, and no provision made for them on retirement. Boys were not keen to join and those in the service were always tempted to leave for better prospects in the private sector".

A good example was the first Chinese candidate to be taken on as a medical apprentice in September

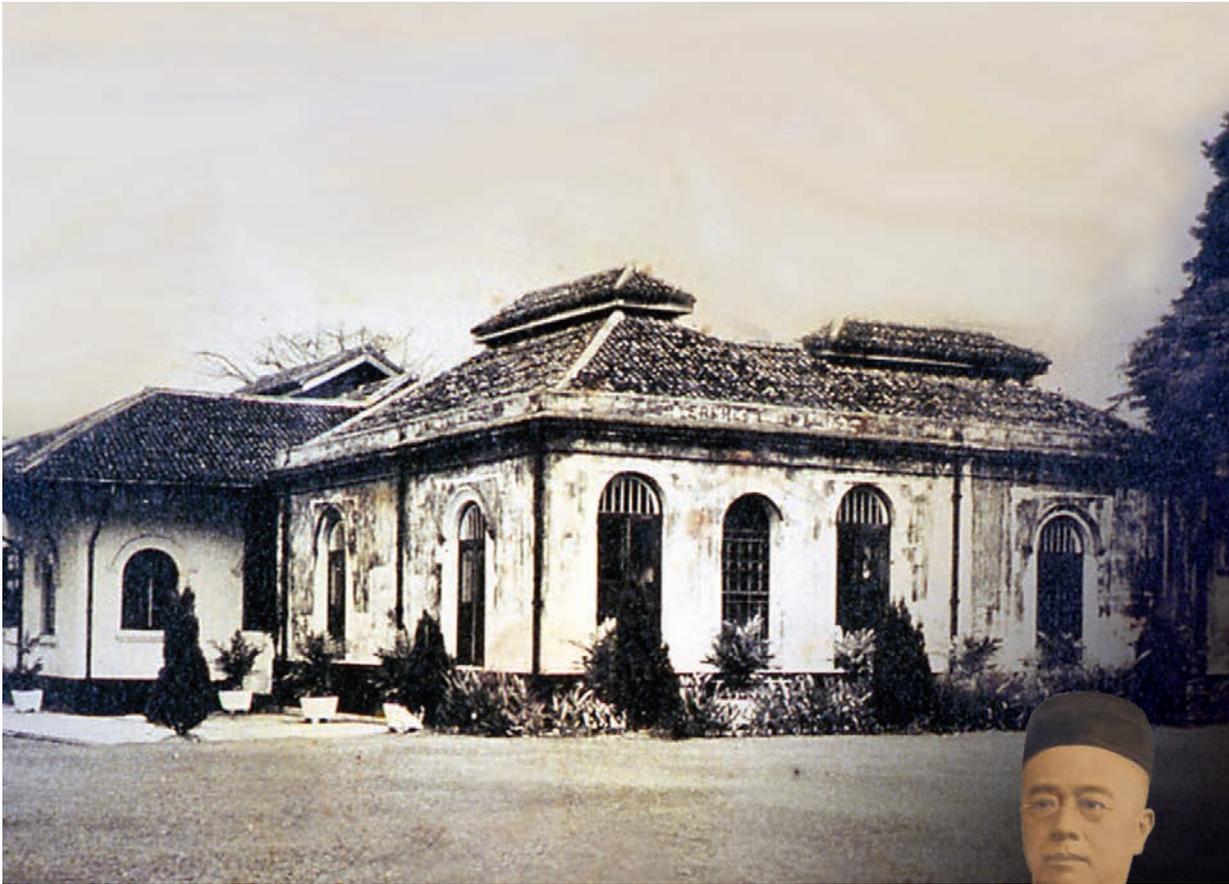
1854 under the assistant surgeon in the Pauper Hospital. He resigned because he could not live on the salary.

Singapore's medical services continued to rely on postings of officers from Britain and India through the 1800s, although a few hardy local young men did apply for training. Various attempts were made through the decades by various officials to raise salaries to entice either local candidates to enrol for training or for officers to accept postings from India, to not much avail.

It was not until 1870 that three local young men were considered fit to be sent to the Madras Medical College for training to become assistant surgeons, with the promise of better pay – a monthly sum of \$45 with an increase of \$10 every three years until a maximum of \$120 was reached. The training carried a 15-year bond. However, only a few – two or three – were sent at any time.



◀ Early clinicians... the medical class of 1925 of the King Edward VII College, posing in front of the Tan Teck Guan Building (right, above) at McAlister Road.



But as trade grew, and with it the economy of Singapore, so did momentum pick up in the building of hospitals – sturdier and with more facilities than their predecessors – and the training of local men to be doctors.

But it would be a long wait, to the turn of the century, before Singapore would have its own medical training facility. Led by leading local merchants and philanthropists such as Tan Jiak Kim (Jiak Kim Street is named after him while the adjacent Kim Seng Road is named after his grandfather Tan Kim Seng), the local community raised the then princely sum of \$87,000 for the establishment of a medical school. Following a successful petition to the Governor-General in India, this money was used to convert the Female Lunatic Asylum at Sepoy Lines into classrooms and laboratories.

Thus, on 28 September 1905, the Straits and Federated Malay States Government Medical School, the predecessor of today's Yong Loo Lin School of Medicine in the National University of Singapore, was officially opened. The inaugural intake enrolled 23 students – nine Chinese, six Eurasians, five Tamils and one Malay, one Ceylonese and one European.

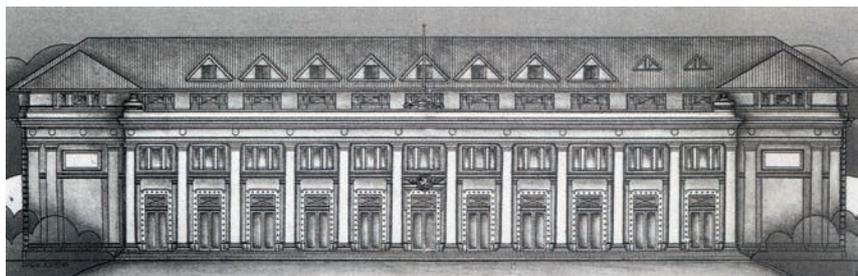
Six years later, in 1911, the medical school finally

► Chipping in... local merchants like Tan Jiak Kim (right) raised the then princely sum of \$87,000 to set up Singapore's first medical school. In 1905, the Female Lunatic Asylum (above) was converted into classrooms but, in 1911, the medical school had a new home: The Tan Teck Guan Building (facing page, top).





► Taking shape... by the time the College of Medicine Building was completed in 1926, it was a faithful rendition of the architect's drawing done in the early 1920s (inset). It housed the medical school's pre-clinical and para-clinical departments, administrative offices, the Medical Library and the Central Auditorium.



19th century orthopaedic drills

It may look a little scary but this is what orthopaedic surgeons used in the 19th century for drilling and tapping before inserting screws into bones. Later, electric drills replaced these hand-powered drills.

had a new home, the Tan Teck Guan Building. It was built from funds donated by rubber tycoon and philanthropist Tan Chay Yan in memory of his father, Tan Teck Guan, the third son of Tan Tock Seng. The school's name was changed to the King Edward VII Medical School on 18 November 1913, to recognise a large donation from the King Edward VII Memorial Fund. In 1921, it was changed again to the King Edward VII College of Medicine.

Meanwhile, a new college building was planned. On 15 February 1926, the College of Medicine Building at the junction of College Road and MacAlister Road was opened. In the following decades, the College of Medicine Building and Tan Teck Guan Building served as the main tertiary institution of medical education in Singapore. Both buildings are now used as the offices of the Ministry of Health (MOH) and are preserved as national monuments.

Early foundations of public healthcare

In 1843, approval was given to build the fourth general hospital on Pearl's Hill, a stone's throw from the site of the first Tan Tock Sing's Hospital



▲ Taking care of the men...a male ward with mosquito curtains at Tan Tock Seng Hospital when it moved to Moulmein Road in 1909.

for paupers. The project was financed by the government and the local community, a growing reflection of the wealth and status of the latter, and opened its doors in 1845. This hospital was even asked to admit mental patients from the European community, even though it was not designed to handle such cases.

In 1860, Pearl's Hill was commandeered for military use by the colonial government. The General Hospital was relocated to the Kandang Kerbau area, its fifth iteration, and was known as the European Seamen's and Police Hospital. It provided treatment for seamen, the police force and female patients (gynaecological complaints and childbirth). Wards were still set up along the lines of gender and economic status rather than treatment for specific diseases. According to the Straits Settlements records of 1864, the site was not ideal, as it was on low ground "near one of the most objectionable creeks" (the present day Rochor and Bukit Timah canals).

An outbreak of cholera in 1873 triggered a temporary move to Sepoy Lines, which eventually became the permanent site for the sixth General Hospital, officially opened in 1882. The hospital would be rebuilt extensively in 1926, and officially opened by then Governor Sir Lawrence Nunns Guillemard.

Meanwhile, the Pauper Hospital at Pearl's Hill had started taking in patients in 1849 to treat widespread dysentery, malaria, tuberculosis and smallpox amongst the growing local population. When Pearl's Hill was commandeered, it too moved to a new site at the junction of Serangoon Road and Balestier Road.

The first maternity hospital was built in 1888 at Victoria Street, the predecessor to today's KK Women's and Children's Hospital.

By the turn of the 20th century, Singapore had become a crown jewel of the British Empire, a bustling trading centre and bastion of its power in the East. Such was its importance that the island merited a visit from King George V and Queen Mary in 1901. By 1904,

► Infection control... Middleton Hospital was built in 1907 to treat patients with infectious diseases.



► Transformation of a General Hospital...

1821: Singapore's first General Hospital started out as a humble wooden shed near Bras Basah Road and Stamford Road.

1822: The hospital moved away from its original site to one closer to the barracks.

1828: Following the collapse of the hospital building in February 1827, a new General Hospital was constructed. Built on a tight budget, the hospital was already in a state of serious disrepair barely two years after it was opened.

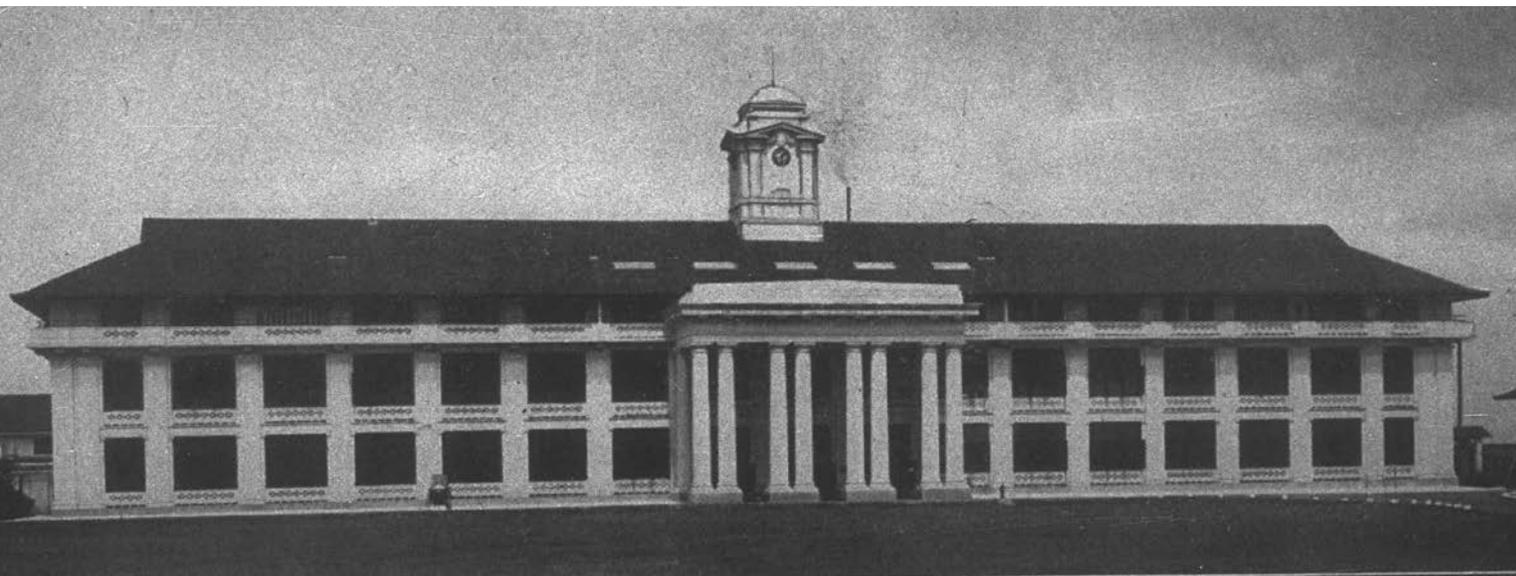
1845: After much delay, plans for a new hospital at Pearl's Hill finally materialised. It was now named the Seamen's Hospital (right, top).

1860: As Pearl's Hill was commandeered for military needs, the hospital moved to the Kandang Kerbau district. However, a cholera outbreak in 1873 triggered a temporary move to Sepoy Lines (right, middle).

1882: Sepoy Lines, now known as Outram Road, eventually became the permanent location of the General Hospital which opened this year (right, bottom).

1926: The hospital was rebuilt extensively and officially opened as Singapore General Hospital (facing page, top).





Singapore was the world's seventh busiest port.

But the health of the population in the pre-war years continued to lag behind Singapore's burgeoning growth. The prevailing diseases then – malaria, venereal disease, tuberculosis, beriberi, pneumonia, enteric fever and ankylostomiasis, or hookworm disease – continued to plague the people. Infant mortality was high and patients were still being admitted to hospitals on the basis of their economic status.

The huge disparity in pay for officers in the two medical services – one for Europeans and one for locals – continued to co-exist and cause unhappiness among the local officers. The late Professor Ernest Steven Monteiro, who served as the Director of Middleton Hospital for Infectious Diseases during the Japanese Occupation and later as Dean of the Faculty of Medicine at University of Malaya (1956–1960), spoke about this in May 1985 interview with the Oral History Centre of the National Archives.

He recalled that "an expatriate medical officer would be drawing \$850. A local graduate would draw \$250. Of course he had annual increments. He was gradually given more salary as the years went by. But the strange thing is that these two services remained apart and caused quite a lot of feelings among the local doctors who all the

time thought they were just as good as the expatriates, especially those recruited from England, raw recruits from the Irish universities who had no experience and just dumped into Singapore".

However, despite the public healthcare system still lacking a systematic approach to the development of hospitals and medical services, a nucleus had begun to take shape.

Most of today's public hospitals were built or rebuilt before the Second World War. In 1907, the predecessor to Middleton Hospital was built as a quarantine camp for infectious diseases. It was relocated to Moulmein Road in 1913 as the Government Infectious Disease Hospital and renamed Middleton Hospital in 1920 after Dr W.R.C. Middleton to recognise his 27 years of work in infectious diseases.

The Pauper Hospital was also on the move because the swampy site was deemed unhealthy for patients. Construction at its current site at Moulmein Road began in 1905 and the hospital moved in in 1909.

Kandang Kerbau Hospital moved to Kampong Java Road from its Victoria Street site in 1924. (In 1997, it moved across the road and was renamed KK Women's and Children's Hospital.



▲ Ending discrimination... in the early years, patients were warded according to their economic or social status, not their medical condition. From 1946, the Unit System saw all medical and surgical wards divided into units under the care of their specialists and patients were given equal treatment.

Its former site now houses the offices of the Land Transport Authority). The General Hospital at Sepoy Lines was rebuilt and opened on 29 March 1926 as the Singapore General Hospital, its seventh iteration.

A lunatic asylum called the Mental Hospital was built in 1928 to treat and house psychiatric cases; in 1951, it was renamed Woodbridge Hospital. In 1993, it moved from its Yio Chu Kang premises to a new building at Hougang and is now called the Institute of Mental Health. The Royal Air Force Hospital (the predecessor of today's Changi General Hospital) opened in 1935 and the British Military Hospital (the predecessor of today's Alexandra Hospital) was established in 1938.

Middle Road Hospital was set up in 1945 to deal

with sexually transmitted diseases and later to also manage skin conditions. Thomson Road Hospital, the last of the pre-independent Singapore hospitals, was built and opened in 1959.

Significantly, it was the opening of the extensively rebuilt Singapore General Hospital in 1926 that marked a watershed in the structuring of Singapore's medical services. The new hospital had few antecedents. It had 800 beds in three blocks, which housed first, second and third class male and female wards, as well as a children's ward. It also had operating theatres, a pathology laboratory, kitchen facilities, an outpatient block and living quarters for nurses.

It broke completely from caring only for seamen and the police to providing modern medical care

to the local people, regardless of race or social background. For the first time, the local people, or natives, had access to government-run health facilities.

But the hospital was still far from perfect. Patients were still assigned to wards based on gender and economic status rather than grouped for specific illness or disease; the distance between the three blocks meant doctors were often delayed in attending to their patients. The small number of doctors then made specialisation difficult, although some doctors developed expertise in specific diseases out of interest and the large patient load. The first record of a specialist appointment was of Dr G.A. Finlayson, as government pathologist for all Singapore hospitals in 1906. He also made significant contributions to the teaching of medical students in the Medical School until his retirement in August 1926.

The fight against disease

In the 1800s and early 1900s, cholera pandemics were common in Singapore, each lasting many years – one outbreak lasted 24 years, from 1899 to 1923; 2,693 deaths were recorded between 1900 and 1920. Before the 1900s, malaria was uncontrolled and it was not until the 1950s that indigenous malaria disappeared from Singapore. Smallpox outbreaks were common too, as was human plague, brought ashore by rats and fleas from ships calling at the harbour. A death rate of 88 percent from plague was recorded between 1900 and 1930.

Public health measures to fight these diseases were two-pronged – quarantine and vaccination. For example, quarantine facilities were set up at St John's Island for those affected by smallpox and vaccinations and immunisation programmes were carried out for smallpox, cholera, polio and diphtheria.

Progress was made, although these efforts were often hampered by "inadequate facilities, shortage of trained staff and strong opposition from the shipping community", in the words of Professor Goh Kee Tai, Senior Consultant in the Office of the Director of Medical Services, Ministry of Health, and an expert in epidemiology and infectious disease. In his study, he also pointed out that "different quarantine requirements by different countries and utter ignorance of the aetiology and epidemiology of diseases resulted in considerable

difficulties, sometimes insurmountable barrier to free transit of goods and people".

Coupled with the growth in population as trade flourished, Singapore was in need of primary healthcare. Many immigrants who had come to Singapore in the early 1900s had taken up farming in the rural areas to support themselves and their families. The lack of personal or public transport in these areas made it difficult for people to get to the hospitals for treatment, even if they could afford it. Healthcare providers showed doughty ingenuity in providing solutions: Outpatient dispensaries took healthcare to those living in rural areas like Sembawang, Bukit Timah and Choa Chu Kang.

In 1910, the first outpatient dispensary was opened in South Canal Road and expanded slowly to other areas – the next one opened in Paya Lebar in 1923. The creation of the Government Travelling Dispensary in 1930, set up at the urging of Singapore's first public health nurse Miss Ida M.M. Simmons, greatly extended the reach of primary healthcare services to the rural and outlying areas where malnutrition led to postnatal beriberi and common childhood diseases. The service was launched with weekly sessions at the Bukit Timah Government Outpatient Dispensary,

**An early
stainless steel
proctoscope
used by doctors
for rectal
examinations**

Not the most comfortable topic, but proctoscopy – a common medical procedure to examine the anal cavity, rectum or sigmoid colon for hemorrhoids or rectal polyps – used to be done with stainless steel proctoscopes in the early days. Today, fibre-optic proctoscopes make the procedure less daunting.





and other dispensary centres were set up in shophouses and temples all over Singapore.

Simultaneously, attention had also turned to reducing the high rate of infant mortality. As early as 1907, the colonial government began setting up registration and treatment centres from which midwives could be dispatched to deliver babies for mothers who could not afford such services and also to give advice on childcare. This effort to provide better maternal care for local women soon became the Maternal and Child Health (MCH) Service.

The service, run largely by nurses, saw house-to-house visits begin in 1910. By 1923, the first MCH clinic was set up as a vaccination centre in Prinsep Street. As smallpox vaccination was compulsory, parents who took their children to the clinic received advice on childcare while the babies were also weighed and checked for growth issues or abnormalities.

Within the next year, Chinatown, which had a high birth rate, got the Kreta Ayer MCH centre which was set up in the converted Rickshaw Station now

◀ Taking medicine to the people... from the 1930s to the 1960s, the Government Travelling Dispensary scheme saw medical workers travel by boat (facing page) and mini-bus (left, bottom) to treat people living in rural areas.



known as the Jinriksha Station. In 1931, the Joo Chiat clinic was set up to serve Geylang, which had a higher concentration of Malays.

In the rural areas, there were no permanent clinics. Most villages and roads had no names then, and nurses trudged down footpaths and muddy roads which were often little more than bullock cart tracks – lugging their bags of records and equipment to deliver service, often in people's homes and even by the roadside. Occasionally, they even had to clamber into sampans to reach the outer islands.

Childbirth and childcare were imbued with taboos, rituals, superstitions and customary practices. The people preferred to consult their bomohs, dukuns, sinsehs or use Indian traditional medicine as they had little faith in Western medicine. The nurses' first job was to build trust before they could dispense medical advice.

The first full-time doctor for the city clinics was hired in the 1930s and the first one for the rural service in 1949. By 1958, there were 13 new clinics for the rural areas. Dr Irene Pakshong, Medical Director of the MCH from 1968 to 1985,



▲ No patient too far... in the 1960s, public health nurses used to clamber into sampans to offer basic medical care to the villagers who lived on Singapore's islands.



▲ Street-side treatment...it took a while for Western medicine to earn the trust of the people and replace the old-fashioned treatment methods.

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remembers working in the Alexandra Road clinic where "there were pigs walking around" the premises.

The Dental Clinic was built in 1938 to provide dental services to the public and government servants.

By the 1940s, medical care in Singapore had undergone a sea change compared to the previous century. The introduction of national health schemes worked in tandem with public health and sanitation measures such as anti-malaria work, sewage and refuse disposal and maintenance of the water supply to improve the health of the population.

The Second World War, from 1942 to 1945, brought this promising momentum to a screeching halt. The war wreaked havoc on the population and on medical services, severely straining manpower and medical supplies. As a result, the civilian population suffered from severe malnutrition and conditions associated with it, like beriberi, were widespread. Malaria was rampant too.

The Occupation destroyed much of the progress made in the preceding 40 years. The Japanese forces commandeered the hospitals for their use, taking over the General Hospital on 18 February 1942 and turning it into the Occupation's main surgical hospital for its troops in

► Occupation degradation... the Second World War saw Japanese forces destroy much of the pre-war progress made so far. An air raid left a row of shophouses in Chinatown in ruins (right) while patients and nurses were left shaken after the British Military Hospital suffered similar damage (below).



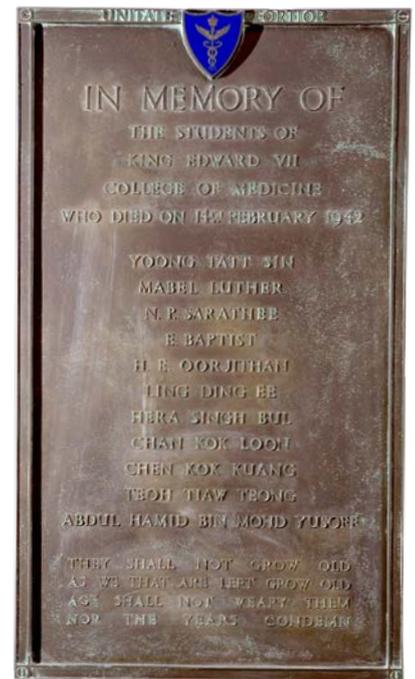
INSIGHTS

Southeast Asia, along with the Mental Hospital and Alexandra Military Hospital. Kandang Kerbau Hospital and Tan Tock Seng Hospital became the main civilian hospitals. The medical school at the College of Medicine Building was closed on 16 February 1942 and the building occupied by the Japanese Army Medical Corps. A medical school was set up in Malacca.

Many died, from bombs and bullets as well as other consequences of war. A cut in water supply to the General Hospital was disastrous. The hospital buried hundreds of the resulting dead in a mass grave on its grounds. A Japanese air raid killed a group of 11 students who had gathered to dig the grave of a student killed a day earlier at the Tan Tock Seng Hospital dormitory, where

he had been on attachment. The bronze plaque commemorating them is still seen in the lobby of the College of Medicine Building today. Postwar, three blocks in the General Hospital were named the Bowyer, Stanley and Norris Blocks to commemorate doctors who died in the war. Only the Bowyer Block still stands as the other two had to eventually make way for hospital expansion.

Once the Japanese left, the British Military Administration faced the enormous yet urgent task of healing the tears in the fabric of Singapore's



▲ Metal memory of mettle... this bronze plaque in the lobby of the College of Medicine Building (the current location of the Ministry of Health) honours the 11 students who lost their lives during a Japanese air raid on 14 February 1942 even as they dug a grave for a student who had been killed a day earlier.



► Midwives in the making... happy faces outside the midwifery school at Kandang Kerbau Hospital in the 1960s.

A badge of honour... and reassurance. In the 1950s and early 1960s, nurses – referred to as Health Sisters at the time – travelled to kampongs to provide basic healthcare to the people. This badge, worn by the Health Sisters, gave them a sense of purpose. It also reassured villagers that the Health Sisters were qualified professionals who could be trusted.



public health services. Primary healthcare – outpatient, maternal and child health and the school health service – was given top priority. But it was not enough.

A 10-year Medical Plan to improve Singapore's health and medical services was approved by the Legislative Council in 1948. Implementation began in 1951, with existing hospitals expanded and modernised, while many new outpatient clinics, maternal and child welfare clinics and infant welfare clinics were built. In the meantime, a Nursing Ordinance came into force in 1949 to regulate the registration, training and professional discipline of nurses, while a Medical Registration Ordinance was enacted in 1953, making housemanship compulsory for doctors.

In 1955, the General Hospital's Paediatric Unit was moved to the Mistri Wing, named after the donor Mr N.R. Mistri. In 1956, the new School of Nursing in Sepoy Lines was opened to train more nurses for the expanding medical services.

In 1958, the Institute of Health was founded, housing all the preventive health services for children under one roof. In 1959, the year Singapore attained self government, Thomson Road Hospital (later renamed Toa Payoh Hospital) was converted from treating the chronic sick to dealing with more serious health issues.

Self-governing Singapore inherited the host of public health problems resulting from high population growth, overcrowding, industrialisation, poor food hygiene, vector-borne diseases and poor sanitation. For the first Minister for Health, Mr Ahmad bin Ibrahim, after whom Jalan Ahmad Ibrahim is named, and his successors, these problems persisted well into the 1960s and beyond. On a positive note, the tenure of these able men marked the beginning of reorganisation and consolidation in healthcare services for the fledgling nation.

Tuberculosis, the major cause of death in 1940s, continued to be a problem well into the 1980s. In 1959, a mass X-ray campaign revealed that one in 27 people were likely to have the disease. Quarantine and vaccination programmes continued against smallpox, diphtheria and polio. In 1959, a mass smallpox vaccination exercise covered 1.1 million people over four weeks. Vaccination against diphtheria had been



◀ Special treat... Franciscan nuns and nurses taking tuberculosis patients for a boat ride in the 1950s.

introduced in 1938 and made compulsory in 1962. With poor public sanitation and food hygiene, cholera outbreaks too were frequent and deadly.

New diseases, aided by greater mobility of people and international travel appeared. In 1957, the Asian flu pandemic swamped medical services – of over 160,000 visits to the government and City Council clinics, 77,211 were for flu. There were 680 deaths among a population of 1,445,900.

Infant mortality was high. In 1959, the infant mortality rate was 36 per 1,000 live births (compared to two in 2013). For a small population of 1.6 million then, there were 63,720 live births but 10,246 deaths. Mothers too frequently died during childbirth. Maternal mortality was 0.7 per 1,000 live and stillbirths (compared to 0.1 between 2001 and 2011).

1 in 27



People in Singapore were likely to have tuberculosis in 1959

Statistics showed that in 1959, cancer caused 10 percent of deaths, heart and circulatory system diseases 9.6 percent, pneumonia 9.3 percent, diseases of early infancy 9.0 percent, tuberculosis 6.1 percent and stroke 4.7 percent.

Even these dire numbers were an improvement on the past decades. So much so that Health Minister Ahmad Ibrahim could report in May 1960 that “a great deal has been achieved as the responsibility of the health services increase”.

He added: “In all, \$37.5 million was spent in 1959 for health; about \$25 per person. The standards achieved must be maintained. And to do this, we must give better training facilities for more of our citizens in the various branches in health. The last year has shown that it is not only possible to maintain standards, but to continue to improve on them steadily.”

And a great deal more needed to be improved.

In a meeting with senior government officials, civil servants, administrators and supervisors connected with the health services, reported in The Straits Times of 14 November 1964, then Prime Minister Lee Kuan Yew painted a stark picture of the state of public health in Singapore. He said: “Singapore is now full of flies. There are many wild dogs and cows running about in the streets, and some of

“A basket case of urbanisation gone wrong... Overcrowding, traffic congestion, flooding, crime, no proper sanitation – name any urban problem and we had it.”



Mr Khoo Teng Chye, who was with the Urban Redevelopment Authority from 1976 to 1996, describing Singapore on the cusp of independence in a 2014 interview with The Business Times

them have been occupying bus shelters as well. The situation looks very grave.”

Fifty years on, in a 31 August 2012 interview with the Centre for Liveable Cities (CLC), Mr Lee spelt out Singapore’s attributes as a modern first world city: Safety, cleanliness, mobility, spaciousness, connectivity and equity.

But Singapore on the cusp of independence was, in the words of CLC executive director Khoo Teng Chye in a 24 July 2014 interview with The Business Times, “a basket case of urbanisation gone wrong”. Mr Khoo, who had served with the Urban Redevelopment Authority (URA) from 1976 to 1996, the last four years as its CEO and chief planner, added: “Overcrowding, traffic congestion, flooding, crime, no proper sanitation – name any urban problem and we had it.”

The fight against these challenges would require the coordinated efforts of the Ministry of Health, the Housing and Development Board and the Ministry of the Environment and, later, the URA after independence in 1965. 

“Caring for our People: 50 years of healthcare in Singapore”; reprinted with the kind permission of MOH Holdings Pte Ltd.

► Waste management... in the early 1800s, night soil carriers carried human waste in buckets slung across their shoulders (inset) and sold it to market gardens and plantations for use as fertiliser. When the first sewerage system was introduced in 1910, the waste was taken to designated night soil disposal stations across the island before it was channelled to treatment plants. If you are wondering why it is called night soil, it is because the waste was collected mainly at night.





Night soil carriers removing latrine buckets from houses. Early Singapore lacked sanitation and diseases spread easily.

WHITHER THE NEXT GENERATION OF MEDICINES?

Associate Professor Roger Foo of the Cardiovascular Research Institute ponders the brave new world of genomic medicine and molecular biology.

Most of us remember what we were doing on the day a global event happened. The day the two planes flew into the twin towers in downtown Manhattan, New York. The day the Berlin Wall came down. The day the tsunami hit the shores of some of our favourite beaches in Indonesia. The day we were told that our founding father LKY had died.

I remember it was a busy day of ward rounds in a busy university hospital unit in 2000, when Tony Blair and Bill Clinton announced that the full human genome was finally sequenced. It was fascinating to hear that the “blueprint” of humans had been revealed, but to the sick patients that were on my list, yet to be seen, yet to be discharged, yet to be assigned a review date, the meaning and relevance of a full human genome map could not have been more remote. Even so, what is not momentous is when events

make incremental advance, and many smaller yet significant discoveries come together, to make the ground-breaking change that we cannot put a date or time to.

At some point since the first human genome was sequenced, we discovered that we have virtually the same number of about 20,000 coding genes as the worm or fish. The coding genome makes up only about one per cent of the whole three billion-bases of the single human genome. It is the section of the genome that encodes for all of the proteins that constitute all of the parts of our cells, and thence all of the parts of our tissues and organs, our hormones, receptors, cellular antigens and so on. These, all from the ~20,000 coding genes.

Coding genes turn out to be pretty much conserved across animal species. Instead, what makes us different from other animals is the vast, approximately 99 per cent non-coding portion of the genome, which turns out not to be “junk DNA” or simply relics from an evolutionary past, but are crucially are important and functional because they are regulatory segments of the genome that are responsible for fine-tuning and regulating how the coding genome is expressed.

This is how, even though every cell from different parts of our body carries the identical DNA blueprint, different sets of genes are switched on or expressed to make a skin cell function differently from a liver cell, or from a brain cell etc. Different sections of the regulatory genome are activated to turn on or off their corresponding genes. The circuitry is

At some point since the first human genome was sequenced, we discovered that we have virtually the same number of ~20,000 coding genes as the worm or fish.

complex, intricate, full of feed-back and feed-forward. Complicated to say the least! The regulatory genome controls gene expression so that a cell manifests its identity.

But what regulates the regulatory genome remains the holy grail of genomic research, and it is a question that could easily turn into one that is philosophical. For now, [Sir John Gurdon and Dr Shinya Yamanaka](#)¹ have at least shown us that if you pick the right regulatory factors (we can call these “molecular switches”), you can control the regulatory genome, and thereby control cell identities, for example by turning or transforming differentiated cell types into pluripotent stem cells. This is one of the many convergent discoveries that I suggest, will contribute to our next generation of medicines.

Some years after the first human genome was sequenced, [Professor Sir Shankar Balasubramanian](#)² delivered the technology that turned out to revolutionise and democratise genome sequencing. Instead of needing \$100m and 10 years to sequence one single human genome, as it did leading to the announcement from Blair and Clinton, Next Generation sequencing technology today allows the sequencing of a human genome within 48 hours, and at ever-decreasing fractions of the cost.

Another convergent moment in history was when one of our young and brightest A*STAR scholars, Dr Sarah Ng, while working in the lab of Dr Jay Shendure in Seattle, cracked a long-standing mystery and uncovered the gene responsible for Freeman-Sheldon syndrome, while making use of the [Next Generation sequencing technology](#)³. From thereon, scientists have made countless breakthroughs, resolving the genetic causes (if there were any) for unsolved diseases and afflictions of mankind.

Consanguineous families have the risk of manifesting rare recessive conditions among their offspring. This is again where sequencing families such as these have revealed “human knockouts”, whose recessive loss or gain of function of specific genes have explained why some of these communities are uniquely prone to, or conversely, [protected against diseases](#).⁴ The identity of these genes has pointed us to new pathways of biology: for example, rare families with mutations in the PCSK9 gene have exceedingly low levels of the [LDL-cholesterol](#).⁵ uncovering not just a previously unknown PCSK9 pathway of cholesterol processing, but pointing to the value of targeting PCSK9 for new-generation, cholesterol-lowering medication.

[Anti-PCSK9 therapy is today](#)⁶ one of the most potent and successful means of controlling hypercholesterolaemia. Besides pointing to worthy drug targets, the existence of living “human knockouts” of the respective genes (who do not have overt medical conditions and are protected against specific diseases), imply these specific gene products could be targeted with drugs. In effect, drug-makers see this as nature already performing the experiments for them, to validate drug safety and efficacy. It shouldn't be surprising to hope then that this approach promises to deliver less tenuous and more fail-safe forms of drug discovery. This must explain why Verve Therapeutics launched with a \$58.5m Series A financing round, led by CV ([formerly Google Ventures](#)).⁷ Verve plans to edit the adult genome, and confer lifelong protection against cardiovascular disease, mirroring the genes of people whose naturally occurring mutations have been associated with lowered risks of heart disease and heart attack.

The discovery of bacterial tools, translated now to successful editing of human genomes (CRISPR/Cas9) means that yet another convergent discovery has made what was once mere wishful thinking possible – to “mend” the human DNA template. Like Next Generation sequencing, CRISPR-editing technology is accessible, democratic, and hundreds (if not thousands) of labs around the world are today working to refine and adapt the tools. Dozens of biotech companies (such as Verve) are leveraging to deliver new generation gene therapy. CRISPR-based RNA editing has also [broken the news](#),⁸ where editing is directed to the RNA transcriptional output of the genome and avoids the risk of heritable transmission. Another prominent company in the news recently has a pipeline of CRISPR-based [RNA-targeting gene therapy](#).⁹

I remember being fascinated as a junior registrar by the notion of “molecular medicine”, and remember also being very curious about the Institute of Molecular Medicine at Oxford, founded in 1989 by Professor Sir David Weatherall. He championed the discovery and understanding of the α and β chains of haemoglobin and their relationship to thalassaemia. Some will say that the reductionist approach to discovery and research has inevitably beaten the path to where we are today, staring down at a very molecular compendium of next generation medicines.

Where single genes may be targeted for rare disease, CRISPR-editing and gene therapy seem the future. For complex conditions, multi-gene and multifactorial, the prospects are for targeting “molecular switches” to re-programme cell identities, reversing the course of diseases, rather than simply slowing down disease progression, which is what nearly all medicines today do. Medical schools might do well to underline the importance of Molecular Medicine in equipping tomorrow's doctors to effectively handle next generation medicines.



A picture drawn by Phase III medical students depicts another case of a chopped-off finger.
From "Being Human: Stories from Family Medicine"

LENDING A HAND

Medical emergencies can happen anywhere, and when they happen in the community, the Family Doctor is sometimes best placed to provide the immediate care required. Starting this issue, we share stories from "*Being Human - stories from Family Medicine*", published in May 2019 by Adjunct Associate Professor Cheong Pak Yean and Dr Ong Chooi Peng. The book contains interesting experiences and memorable encounters that make up Family Physicians' typical and occasionally, atypical work days.

In 2005, a polyclinic doctor was called to attend to a 17-year old youth bleeding with "a missing left hand". He had been attacked viciously over a staring incident. He was trying to shield himself with his left arm from a 30cm parang* aimed at his head: the blow sliced his left hand off completely at the wrist.

After stabilising the patient, the doctor quickly went to the site of the attack and managed to find the severed hand on a pavement about 300 metres from the polyclinic. The hand was placed in a box packed with ice and quickly transported with the patient to the National University Hospital. After a 10-hour operation, a team from the Hand Surgery Department was able to successfully reattach the youth's hand and restore function to it. The surgeons attributed the operation's success to the quick-thinking actions of the polyclinic doctor. He had made all the difference. This incident was reported in the press in



Dec 2005, but the polyclinic doctor's name was not revealed. That person is Dr Choong Shoon Thai (NUS Medicine Class of 1997) from Jurong Polyclinic.

He said medical practice in a clinic located in the community meant that once in a while, he would attend to medical emergencies and trauma cases. "My experience (not just in family medicine, but over the course of my postings after graduation) have taught me to always stay calm, remember the basics, and think before I act. My decisions on the day of the incident were informed by the knowledge that I gained during my hand surgery and orthopaedic postings; however, the reason I was able to leave the patient's side and retrieve the severed hand was because of my confidence in my colleagues at the clinic to manage the patient while I was away."

He recalls the dramatic episode in a recently published 168-page book, "Being Human: Stories from Family Medicine", which is a compendium of 72 drawings by Yong Loo Lin School of Medicine students, with accompanying commentaries by doctors.

"I was called to the emergency room of the clinic to attend to a case of "hand amputation". The patient's hand had been cut off above the wrist and the ends of his radius and ulna (forearm) bones could be clearly seen. The cleanness of the cut meant the blood vessels were well-

constricted with remarkably little bleeding.

I instituted first aid measures and called for help from my colleagues at the same time. We learned from the patient that he had been attacked nearby by someone wielding a parang. In the aftermath, he had escaped to our clinic, leaving his severed hand behind.

I knew that the success of reattachment surgery depended on the hand being kept cool, and on the surgery being performed as soon as possible. Time was critical, and I did not want the ambulance to take the patient to the hospital without his hand!

Leaving the patient with my colleagues, I followed the trail of blood.

The amputated hand was lying on the pavement beside the main road, some 300 metres from the clinic. We wrapped the hand in gauze moistened with saline and placed it into a clean plastic bag inside a cooler box with ice, and it accompanied the patient to hospital in the ambulance.

We learned later that the hand had been successfully replanted."

*A parang is a machete.



Dr Chan Khye Meng's clinic has been around since 1964. (Photo: Darius Boey)

THE FATHER OF TANGLIN HALT

The accidental doctor who's hanging up his stethoscope after 55 years

Wedged in between a hair salon and an interior design office, Meng's Clinic stands like a time capsule in the middle of the busy Tanglin Halt neighbourhood.

A faded sun-bleached white and red sign hangs above the now-yellow doors. Inside, large yellowing benches frame the sides of the clinic, and a small square hole allows the receptionist to peer out at patients.

"Everything here is from (1964)," said Dr Chan Khye Meng, pointing to the furniture, the doors and the walls.

This is Dr Chan's 55th year at Tanglin Halt. Now 86 years old, and with a dwindling number of patients, he is finally ready to hang up his white coat for good.

A Doctor by Accident

"I always say I became a doctor by accident," said Dr Chan. When he finished taking his O-Levels, he had no idea what he wanted to do with his life. At the time, his second sister was dating a dental student, whose uncle was a general practitioner in Melaka.

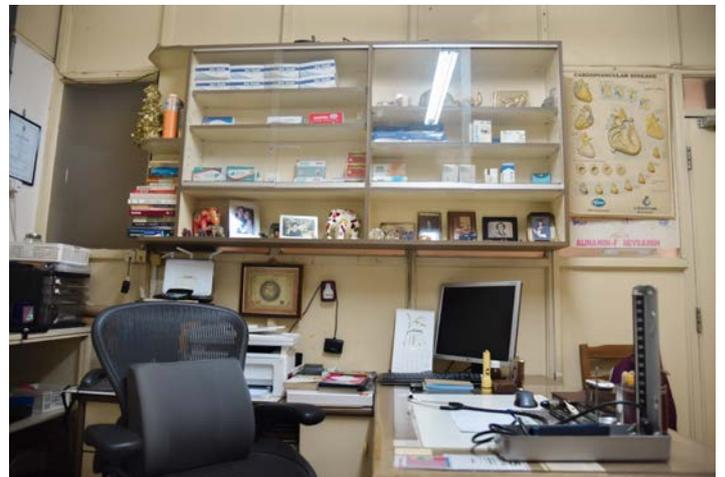
"Wah, he was doing a good business. I see the family every

time all going on holiday (to) fly here, fly there. I said, I want to have a good life like that, you know?" he said.

So he sat for the entrance examinations and emerged as one of two students from Melaka offered a place to study medicine at the University of Malaya, which at the time was located in Singapore.

His eyes twinkled as he recalled the moment he learned that he had been accepted.

"That was the best time of my life, to get this kind of result," he said.



A view of Dr Chan's consultation room. (Photo: Darius Boey)



Dr Chan writes a prescription for a patient. (Photo: Darius Boey)

After university, he worked as a doctor in both Melaka and Johor Bahru for about five years, until he was approached by two medical sales representatives. At the time, he was also looking to leave his post.

“They said, why don’t you try working in Singapore? There’s a new estate called Queenstown.

“I said, maybe a good idea, you see?” said Dr Chan.

In 1964, Dr Chan put in a tender for a clinic in Queenstown, paying S\$600 a month in rental for the small space.

A Turbulent Period

In the first month of opening his clinic, Dr Chan had no patients at all.

“When I started, I’m the fourth clinic... So in the first month, I didn’t even see one patient. Can you imagine how depressing it was?

“People are not sure about me, you see? Because I was still very young and they thought I had no experience,” he said. Although he told his father that he wanted to give up and work in Brunei instead, his father persuaded him to stay for at least another month. Things looked up in the second month, when the Tanglin Halt market opened and the area got busier.

“The first time I got my first patient, I was so happy. Just to cover the day’s rent, forget about making money,” he said. As a new doctor, he had to work hard to build up his practice, so he held three consultation sessions a day.

“In those days, those booming days, it (was) so different. (During) the first Asian flu, I used to see about a hundred patients a day. Non-stop, no lunch. After one hundred, I said, ‘no more, cannot give (anymore queue numbers)’. I already exhausted, lah.

“But they come in by the back, you see? That time was madness. Work like mad,” he said.

Not only did Dr Chan have to contend with a heavy workload, he also had to deal with the rampant crime in the neighbourhood, especially in the early years. He remembered how many shops in the area often received extortion letters and even live bullets.

The gangsters slipped a letter under his door demanding S\$30,000 - the cost of Dr Chan’s flat at the time. The extortion only stopped when Dr Chan saved the life of one of the gangsters, who had come down with a case of acute appendicitis.

Dr Chan remembers many of his patients well. In particular, one who visited Dr Chan until she died about two years ago.

ALUMNI VOICES



(From left) Doris, the pharmacist for Meng's Clinic, Mr Jeremy Villenguez, Mdm Angeline Lim and Dr Chan pose for a picture. (Photo: Marcus Ramos)

She had become depressed after losing her daughter to suicide.

As he spoke about her, his voice grew soft.

"Sometimes when she gets into that kind of mood, she will scold me, you know? But I know she didn't mean it, because (in her state), it's like that," he said.

He added that she used to sing bhajan, or Tamil hymns, when she visited.

"She'd come inside here, she sing and she do the Indian dance. Strange," he said, shaking his head with a smile.

Another patient he remembered vividly was a man who had passed away in his clinic from a heart attack: "He was waiting for his turn and he collapsed. So the other patient brought him into my room, I said, he's already dead!"

While he had never seen the man before, he later learned that the man's wife and children were regulars at his clinic. "(I called the wife), she sent the son here. She didn't come. (I told) the son, hey, where's your mum? Your father died here, dead already, what your mum doing?"

"That was a very unpleasant experience," he said.

An Honest and Compassionate Doctor

For many patients, Dr Chan has been around for so long that he has become part of the fabric of Tanglin Halt.

On a Facebook post by heritage charity My Community, there were at least 50 comments lamenting Dr Chan's retirement. Many remembered seeing Dr Chan as a child. Mdm Angeline Lim's family has been seeing Dr Chan for three generations.

It started with her mother-in-law, who visited Dr Chan often before she died, followed by Mdm Lim and her husband, and after that, her sons.

"Dr Meng is very good. And he's very friendly... For me, (we are) like a brother and sister... He's (like) the father of Tanglin Halt," she said.

For her son, Mr Jeremy Villenguez, it is Dr Chan's honesty that keeps him coming back.

"He doesn't upsell. He just tells you as it is... And that really appeals to us, that he is taking us very seriously and he's treating us like family," he said.

Speaking in Mandarin, a patient who identified herself only as Mdm Ye recounted Dr Chan's kindness to his patients. She has been a patient of Dr Chan for 51 years.



Dr Chan locks up the back door of his clinic as he prepares to leave for the day. (Photo: Marcus Ramos)

“When he was younger, he would also do home visits for old folks who have difficulty moving,” she said.

She added that he had more patience than other doctors, and would listen to patients speak for as long as they wanted.

“(Some people) will consult him for half an hour. When I wait at other places, we’ll go in for just 10 minutes then get out,” she said.

Just being able to help patients is its own reward for Dr Chan.

He remembers an old lady who came from China to work as a servant, who relied on the charity of various Chinese temples to survive.

“This old lady, about 90 years old already... Sick, very sick. How to see a doctor? Cannot travel, no money. I went to see her (and) she wanted to pay me.

“You know, that time her hand already trembling. She took out the red packet, ang pow, that she had been keeping God knows for how many years until it became tattered, you know? Then pulled the money out to give to me, pay me.

“How can I accept the money? No, no way. I said, you keep

for your own use. So you see, when they come to see me and say, Doctor, I have no money, I say, don’t worry, I’ll treat you,” he said.

Make Use of My Twilight Years

Dr Chan already has grand plans for his retirement. Not only will he spend the additional time pursuing his hobbies of singing and gardening, he also plans to travel more with his wife and revive the stamp collection he has been putting off for four decades.

When asked if he has any regrets, Dr Chan said he doesn’t. “But I said (to my wife), if I have a chance again, I would be a conductor rather than a doctor ... I said, if I reincarnate, I want to be the conductor and you become one of the sopranos,” he said, laughing.

Reflecting on the prospect of leaving his clinic, Dr Chan sounded tired.

“Oh, I feel very sad, really. Because I’ve spent more time here than I spent at home.

“What to do? Everything have to come to an end lah. So this is just a good time as any. At 86, I must make use of whatever time I have in my twilight years to enjoy my life, because I’ve been working all these years. It’s crazy.”

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EVERY NURSE'S NURSE

Professor Violeta Lopez left her position at the NUS Alice Lee Centre for Nursing Studies in June. She reflects on a healthcare career spanning many decades.



PEOPLE OF NUS MEDICINE



Professor Violeta Lopez accepted an appointment at the National University of Singapore (NUS) thinking it would be the last stop in her career as a nurse, researcher and educator.

When she left NUS in June, however, she hadn't hung up her many hats yet. She has a few more stops to make and many more people to help, before she calls it a day.

With a career that spans 45 years and several continents, Prof Lopez is a nurse's nurse – a much sought-after educator, researcher and consultant in global nursing circles. Now that she has left her full-time position at NUS, she has accepted several part-time appointments at universities in the Philippines, China and Australia, where she will teach, conduct research and help these institutions strengthen their academic programmes and build up their research excellence.

"I don't think I will ever stop working, as there are many organisations and causes that I can still contribute to," says Prof Lopez.

One of these is giving back to nursing in her homeland, the Philippines, under the auspices of the government's Balik (Return) Scientist Program, which aims to draw Filipino scientists back home to set up their own research centres or teach, she says.

She also hopes to contribute to the philanthropic work started by her late mother at Suhay ("Strong Support"), a charity organisation that provides medical care and scholarships to rural communities, and financial aid to an orphanage.

Beginnings

It was her mother who inspired her interest in nursing, says Professor Lopez, while her late father, a university professor, was the role model for her academic career.

"I was brought up helping people," she says. "When I was young, I would follow my mother to the rural areas to participate in the array of good causes her charity organisation was involved in. At a young age, nursing and community service quickly became an interest of mine," she adds.

She earned a Bachelor's degree in Nursing from the University of the Philippines and worked as a nurse for two years before responding to a call for nursing-trained volunteers by the US Aid for International Development in the mid-70s. "It was something I had never done before and I was intrigued by the opportunity to serve in a developing country, so I resigned from my job and signed up," she recalls.

The Agency sent her to a provincial hospital in Laos to

PEOPLE OF NUS MEDICINE

provide community nursing care in collaboration with a team of doctors, nurses, nutritionists, pathologists and dentists. She also helped to train the local nurses to take over after the team's departure.

The stint was the highlight of her clinical career as it exposed her to the challenges of nursing in an underdeveloped country. "The limited resources forced us to look at innovative practices to provide quality care," she says.

She vividly remembers taking unconventional means of transportation – from rafting to riding on elephants – to reach the remote villages across the Mekong river.

The many lessons she learnt on transcultural nursing would later become one of her research interests.

"In transcultural nursing, we must be mindful of a community's cultural practices, beliefs and values. I learnt to respect the old ways of treatment and introduce the new ones with sensitivity," she says.

"I understood then that alternative medicine and non-pharmacological interventions stood the test of time because they increased adherence to treatment plans," she adds.

Australian academia

After the team's evacuation from Laos as a result of escalating tensions from the Vietnam war, Prof Lopez moved to Australia where she worked as a critical care nurse at Sydney Hospital.

In those years, she completed her Master of Professional Education and Training from Deakin University and Master of Nursing Administration from the University of New South Wales. She also earned a PhD from the University of Sydney. Her career has been an interesting blend of clinical work, academia and research ever since.

Prof Lopez believes all nursing academics should hold joint appointments in higher education and clinical settings in order to be credible teachers who can bridge the theory-practice gap. She continued to practise after she started teaching at the Australian National University and University of Sydney. The only gaps occurred when she left

Australia to work at the Chinese University of Hong Kong in 1997 for seven years, and at NUS in 2013 for six years.

"Students value teachers who can teach what is practised in the clinical arena. For me, it was the best of both worlds when I could blend my clinical and teaching practices in one piece," she reflects.

Prof Lopez returned to Australia in 2005 to take on headship of the School of Nursing at the Australian Catholic University, in her first stint in management.

“In transcultural nursing, we must be mindful of a community’s cultural practices, beliefs and values. I learnt to respect the old ways of treatment and introduce the new ones with sensitivity, ”

International assignments

She has made many contributions to developing countries as a curriculum development consultant. In 1988 and 1989, she was assigned by the Australian Agency for International Development to assist the Universiti Sains Malaysia to develop its Diploma, Bachelor's and Masters nursing curriculum. She was also invited by the Oman Ministry of Health to develop a critical care curriculum for the nursing school in Muscat, and by the School of Nursing at Aga Khan University in Pakistan to conduct research workshops.

In 1993, she spent two years in Jordan teaching at the Applied Science University and also collaborated in research with the University of Jordan and Jordan University of Science and Technology. Since 2007, she has been a Chutian Scholar at the College of Nursing at Hubei University of Medicine.

Prof Lopez's research interests are in transcultural nursing, cancer symptom management, caregiving, psychoeducational interventions, as well as the development, translation and psychometric evaluation of research instruments. She has obtained over S\$5 million in research grants and published 300 journal articles, books and book chapters. She is a peer reviewer and is on the editorial boards of many international medical and nursing refereed journals.

PEOPLE OF NUS MEDICINE



Prof Lopez received the Presidential Lifetime Achievement Award from then President Barack Obama in 2017

In 2018, her efforts were internationally recognised when she was inducted into the Sigma Theta Tau International Nurse Researcher Hall of Fame. She also received the Presidential Lifetime Achievement Award from President Obama in 2017.

Because of her deep research expertise, Prof Lopez has successfully supervised 25 international PhD students, including eight from NUS Nursing and two MPhil students from NUS Dentistry. As a result of her international reputation, she has also been invited to be an external examiner for 60 PhD students from eight countries.

“My highlight as an educator is that my PhD students have now graduated and are enjoying success as professors, consultants and published researchers. My greatest joy has been to see them succeed,” she says, adding that many still keep in touch with her about their progress.

NUS legacy

During her time at NUS Nursing, she helped the Centre to establish its SalUtogenic Nursing (SUN) Research programme and assisted it to be designated as an ICN-accredited centre for research and development. It is one of 15 in the world.

Though she will leave NUS Nursing, her work here continues through collaboration with colleagues in research, publishing and co-writing books and book chapters, as well as helping them develop their international network.

“My advice to researchers is to build their own research programme, track record, and most importantly, their national and international network. With these three pre-requisites, they will find success in obtaining competitive research funding,” she says.

AUGUST SEPTEMBER OCTOBER

10 August

Rag & Flag

Bishan-Ang Mo Kio Park, Ficus Green

13 August

Keynote Address

University Cultural Centre (UCC), NUS

15 August

White Coat Ceremony

University Cultural Centre (UCC), NUS

06-07 September

NUHS Innovation Summit

Level 1, Auditorium, NUHS Tower Block

07 September

Medical Grand Challenge

Level 1, Auditorium, NUHS Tower Block

12 September

Mass Spectrometry Imaging Symposium

Level 1, Auditorium, NUS Clinical Research Centre (MD11)

14 September

Educators' Day

Level 1, LT35, NUS Centre for Translational Medicine (MD6)

30 September

**CENTRES 9th International Clinical Ethics Conference:
Recent Legal Developments and their Implications
for Healthcare Practice**

Kent Ridge Guild House, NUS

Details are subject to change.

Inspiring Health For All



Yong Loo Lin
School of Medicine