Synergising medical research

Professor Wong Tien Yin describes his organisation’s blending of clinical expertise with academic research in structured programmes designed to deliver benefits to patients.

To begin, could you describe your responsibilities within Singapore Health Services (SingHealth)?

I have several roles. As the Group Director for Research at SingHealth, I provide strategic leadership to the Research Directors and Academic Clinical Programmes (ACPs), on the development of biomedical, clinical and translational research within the group. In addition, I oversee and manage SingHealth’s research support services, laboratories and core research platforms, such as the SingHealth Experimental Medicine Centre, Investigational Medicine Unit and Tissue Repository. I identify, train, nurture and mentor clinician scientists/investigators in alignment with the strategic goals of SingHealth; and work collaboratively with the Academic Medicine Research Institute (AM+RI) which focuses on developing clinician scientists. Lastly, I build partnerships to enable the SingHealth research community to cultivate and develop collaborations with local, regional and international partners.

When was SingHealth established? How has the organisation developed?

Formed in 2000, SingHealth is Singapore’s largest healthcare group, comprising two public hospitals, five specialist centres – the National Cancer, Heart, Eye and Dental Centres of Singapore and the National Neuroscience Institute – and a network of nine polyclinics. Singapore General Hospital (SGH), which was established in 1821, is the flagship hospital with the highest clinical throughput. Together with KK Women’s and Children’s Hospital (KKH), the specialist centres and the polyclinics, the group is home to clinicians and healthcare providers across more than 42 medical specialties from primary to tertiary care.

In 2009, the Ministry of Health encouraged SingHealth and Duke-NUS Graduate Medical School (see p28) to come together to form a second academic health system. As SingHealth and Duke-NUS both relentlessly pursue improvements in caring for patients, the mandate gave us the impetus to embark on a journey into academic medicine. This gave birth to the formation of the ACPs within the SingHealth Group, and the establishment of AM+RI and the Academic Medicine Education Institute (AM+EI) under Duke-NUS. Together, the partnership aims to create a vibrant academic medicine culture at SGH and KKH campuses, focused on improving the future of medicine while putting patients at the heart of all we do.

SingHealth’s mission statement outlines three key goals: Care to Heal, Educate to Empower and Innovate to Advance. How are these concomitant aims pursued?

Our mission is realised in our Academic Medicine partnerships, which includes our strategic alliance with Duke-NUS. Our clinicians have been involved in academic medicine since SGH was formed. In fact, SGH was home to the first medical school in Singapore before it relocated and became the National University of Singapore. We also form partnerships in academic medicine to reinforce our position that educating the next generation is a key part of our ecosystem, and that research is the path we take to bring about medical advancement for the benefit of our patients. The Academia is a tangible example of our determination; bringing clinical service, education and research under one roof. Ultimately, our patients are at the heart of all we do, and we believe that by investing in education and research we can live up to our philosophy.

How does your partnership with Duke-NUS assist the development of academic medicine? Who are some of your other collaborators?

Academic medicine brings together the brightest educators and the most committed researchers to deliver the best possible care to patients. There is a natural interconnectivity between SingHealth and Duke-NUS because we are both located on the same campus, which is also home to SGH and four of our national specialty centres: the National Cancer, Heart, Eye and Dental Centres. This creates plenty of opportunities for our clinicians, scientists and faculty to interact and form research collaborations. These interactions also enable scientists, clinician scientists and academics to tap into each other’s experience in developing research and education strategies. The six research focus areas that have been jointly identified by SingHealth and Duke-NUS research thought leaders for the partnership build on our current strengths, and it is our collective strengths that will attract pharmaceutical companies and other research institutions to collaborate with us.

SingHealth is also home to the Roche Translational Medicine Hub which was set up in collaboration with Roche; and the Personalised OMIC Lattice for Advanced Research and Improving Stratification (POLARIS) initiative, which is a nationwide stratified medicine endeavour involving the Agency for Science, Technology and Research’s (A*STAR) Genome Institute of Singapore and the Bioprocessing Technology Institute as well as healthcare partner, chief among SingHealth specialist centres. This is one of many nationwide research initiatives that are being set up now.

Do you see preventative and personalised healthcare as being more important in the future, and is SingHealth making any progress in these fields?

SingHealth has been developing personalised medicine through research for a long time. Four SingHealth clinicians, namely Dr Tony Lim (SGH), Drs Ian Tan and Daniel Tan (National Cancer Centre Singapore), and Dr Eranga Vithana (Singapore National Eye Centre) are now collaborators on POLARIS – an initiative which will translate ‘omic’ capabilities (such as genomics, proteomics, metabolomics) from a research setting into clinical application, for better diagnosis and treatment of diseases for patients in Singapore.

Education is one of the primary drivers of your organisation. In what ways are you nurturing the next generation of healthcare professionals and researchers?
SingHealth and Duke-NUS have set a target of grooming 80 clinician scientists, half the national target of 160 by 2015. With the formation of the ACPs and AM•RI, the partnership hopes that academic rigour and an inquisitive culture will encourage more clinicians to take up research as part of their career and development. The formation of AM•RI will help to equip budding clinician scientists with the basic skills to embark on their quest for knowledge, while the new structure and mandate of the ACPs should create a much-needed environment for research to flourish.

With the slogan ‘Defining Tomorrow’s Medicine’, how do you hope SingHealth will shape the future of healthcare?

Through academic medicine, we hope to discover new ways to screen, diagnose, treat and prevent disease, via multidisciplinary translational research combining pure science, clinical science and population science.

SingHealth and Duke-NUS have partnered on a number of ambitious projects:

**Cancer drug efficacy** – a team of 55 researchers, led by Associate Professor Ong Sin Tiong of Duke-NUS recently found a mutation in a gene particularly common in East Asians that makes some cancer drugs less effective, as well as a solution to this problem, which involves administering another drug that is not currently commercially available.

**Antiviral for dengue fever** – SingHealth’s flagship hospital SGH, together with researchers at the Program for Emerging Infectious Diseases at Duke-NUS have started a clinical trial using Celgosivir, a new drug derived from the seeds of the Moreton Bay Chestnut tree, to determine its efficacy as a treatment for dengue fever. The trial is carried out under the STOP Dengue Translational Clinical Research Programme.

**Stomach cancer** – led by researchers from SingHealth and Duke-NUS, including Professor Teh Bin Tean, Associate Professor Steve Rozen and Associate Professor Patrick Tan, a project looking for genes that affect the growth of stomach cancer has successfully identified hundreds of critical genes, potentially contributing to a tailored cancer treatment in the future.

**Natural killer-/T-cell lymphoma** – Professor Teh Bin Tean, and Associate Professors Patrick Tan and Lim Soon Thye from Duke-NUS and the National Cancer Centre Singapore have reported the first comprehensive genomic study of natural killer-/T-cell lymphoma this year, shedding light on the cause as well as uncovering potential treatment targets.
Academic medicine

Collaborative research between investigators at Singapore Health Services and the Duke-NUS Graduate Medical School has brought significant advances in understanding to a variety of conditions. Further collaborations with other institutions in key areas will continue this trend for the benefit of patients around the world.

DEVELOPMENTS IN TECHNOLOGIES that underpin advances in genomics, proteomics and molecular biology, such as imaging and high-throughput sequencing, mean that the potential of finding the root causes and thus the solutions to medical problems is greater than ever before. The ability to translate the ever-growing body of biomedical knowledge into effective diagnoses and therapies, however, relies on close interaction between basic scientists and practicing clinicians. Integrating these two – pure science and clinical medicine – is a valuable strategy for expediting the development of medical techniques that allow clinicians to treat patients safely. This is the rationale for the ownership between the Singapore Health Services (SingHealth) group of hospitals and specialist clinical centres and the Duke-National University of Singapore (Duke-NUS) Graduate Medical School.

To Professor Wong Tien Yin, the Group Director for NUS) Graduate Medical School.

SingHealth and Duke-NUS have identified six areas of research on which they will jointly focus investment over the next five years: Oncology; Cardio-metabolics; Infectious Diseases, Inflammation and Immunology (I3); Ophthalmology; Neuroscience; and Health Services Research – "SingHealth has come a long way in delivering medical care and in developing academic medicine," explains Wong. "These research foci reflect the existing strengths of SingHealth and Duke-NUS; that said, members of the healthcare community within SingHealth are not discouraged from pursuing research on topics outside these areas." To help meet government targets for a new class of clinician scientists, Wong is also actively involved in the formation of the Academic Medicine Research Institute (AM•RI), which focuses on clinician scientist development.

The Academia

Opening its doors on 20 July 2013, The Academia will boost SingHealth’s translational and clinical research efforts. Spanning a total gross floor area of 75,000 m², The Academia aims to encourage interconnectivity and collaboration between pathologists, clinician scientists, researchers, academics, educators and medical students. It will welcome more than 1,500 healthcare professionals into its two towers – the Diagnostics Tower for SGH’s Department of Pathology and the Discovery Tower for SingHealth research and education – to work together to discover new treatments and diagnostic capabilities.

The Discovery Tower will empower SingHealth’s clinician scientists and research partners to conduct groundbreaking translational medicine research with four new research platforms: the Proteomics, Advanced Bio-imaging, Clinical Pharmacology and Flow Cytometry Core Platforms.

NATIONAL CENTRES

SingHealth researchers have also been making strides in other collaborative efforts. One example is a project at the National Heart Centre Singapore, where scientists have transformed a patient’s skin cells into beating heart cells, using a virus-free method to create human-induced pluripotent stem cells. The new cells could replace damaged heart muscle in heart failure patients and delay the need for a transplant – and since the stem cells originate from the patient, the risk of rejection is negligible.

A further study at the Singapore National Eye Centre discovered the genes associated with the onset of primary angle closure glaucoma, a leading cause of blindness which affects 15 million people worldwide, 80 per cent of whom live in Asia. Glaucoma and scarring after corrective operations for the condition are more prevalent in Asians than Caucasians, and another research project led by the Singapore Eye Research Institute has developed an effective treatment in the form of a gel for preventing postoperative scarring in the eyes of glaucoma patients which is retained in the eye for longer than the usual liquid treatment and reduces the need for repeat administrations.

The success of this, or any such partnership, is mutuality: "Bench-to-bedside research requires collaboration between scientists and clinicians with a common understanding of each other’s capabilities and roles, as well as aligned scientific interests," he affirms. "In Asia, relationships such as friendships play a big part – but it is only when both parties place personal achievements as secondary that true scientific advances are made."
SINGHEALTH RESEARCH OBJECTIVES
Collaborating with research partners to achieve common research goals and to bring real benefits to patients.

KEY RESEARCH PARTNERS
Duke-NUS graduate Medical School
A*STAR Research Institutes, Singapore
Leading academic institutions
Reputable biotechnology and pharmaceutical companies

RESEARCH FUNDING
Funded by various national grant funding agencies and through commercial collaborations

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Professor Wong Tien Yin is concurrently Group Director (Research), Singapore Health Services; Executive Director, Singapore Eye Research Institute; Senior Consultant Ophthalmologist specialising in retinal and macular diseases at the Singapore National Eye Centre; Provost’s Chair Professor and Head, Department of Ophthalmology, National University of Singapore and National University Hospital. During his career, he has published more than 350 papers and given more than 100 invited, named, plenary and symposium lectures around the world. Wong is on the Editorial Board of Investigative Ophthalmology and Visual Sciences, the American Journal of Ophthalmology, Ophthalmic Epidemiology and Diabetes Care. He was also a recipient of the inaugural Singapore Translational Researcher Award (STaR) in 2008. In 2010, he received the National Outstanding Clinician Scientist Award from the National Medical Research Council and the President’s Science Award, the highest accolade in Singapore.

PERSONAL RESEARCH
A perfect example of academic medicine in practice is Wong’s own research: “I lead an interdisciplinary programme that combines computer science and bioengineering, ophthalmology, epidemiology and clinical research, based on the concept that the eye is a model to study cardiovascular diseases,” he highlights. “My team and I have developed advanced computing imaging software, and have applied these techniques to large epidemiological and clinical studies totalling more than 30,000 people.” The researchers led by Wong have designed techniques to measure the morphology, patterns and changes in various parts of the eye (blood vessels, nerve, lens, cornea). Using these measurements, they have developed a unique, non-invasive platform to assess human diseases not only in the eye but elsewhere in the body.

Wong has shown that subtle blood vessel changes and damage seen in the eye can be used to predict and track a person’s risk of stroke, heart disease, diabetes and hypertension. It may even be possible to screen and detect hypertension and cardiovascular disease early by a simple eye scan. A breakthrough like this would be of major significance in early diagnosis and prevention, as stroke, heart disease, diabetes and hypertension are four of the leading causes of death worldwide. “My research showing an increased risk of heart disease in women with retinal signs of vascular damage has provided a key to understanding the importance of the microvasculature in heart disease pathogenesis in women, and is now included in the American Heart Association’s guidelines on the ‘Role of Non-invasive Testing in the Clinical Evaluation of Women with Suspected Coronary Artery Disease’,” enthuses Wong.

His proof of concept that a non-invasive eye examination may have value in stratification of patients at risk of cardiovascular disease is now also included in international clinical guidelines, such as those issued by the 7th Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. So far, Wong’s eye imaging technology has resulted in eight patents, licensing to companies and several late-stage clinical trials.

SingHealth’s mission is summed up as Care to Heal, Educate to Empower and Innovate to Advance: Wong is confident that the strategic alliance with Duke-NUS, through targeted research programmes and the meticulous development of a new generation of multi-skilled clinician scientists will give rise to further medical breakthroughs in all of the organisation’s research focus areas.

Integrating pure science and clinical medicine is a valuable strategy for expediting the development of medical techniques that allow clinicians to treat patients safely.