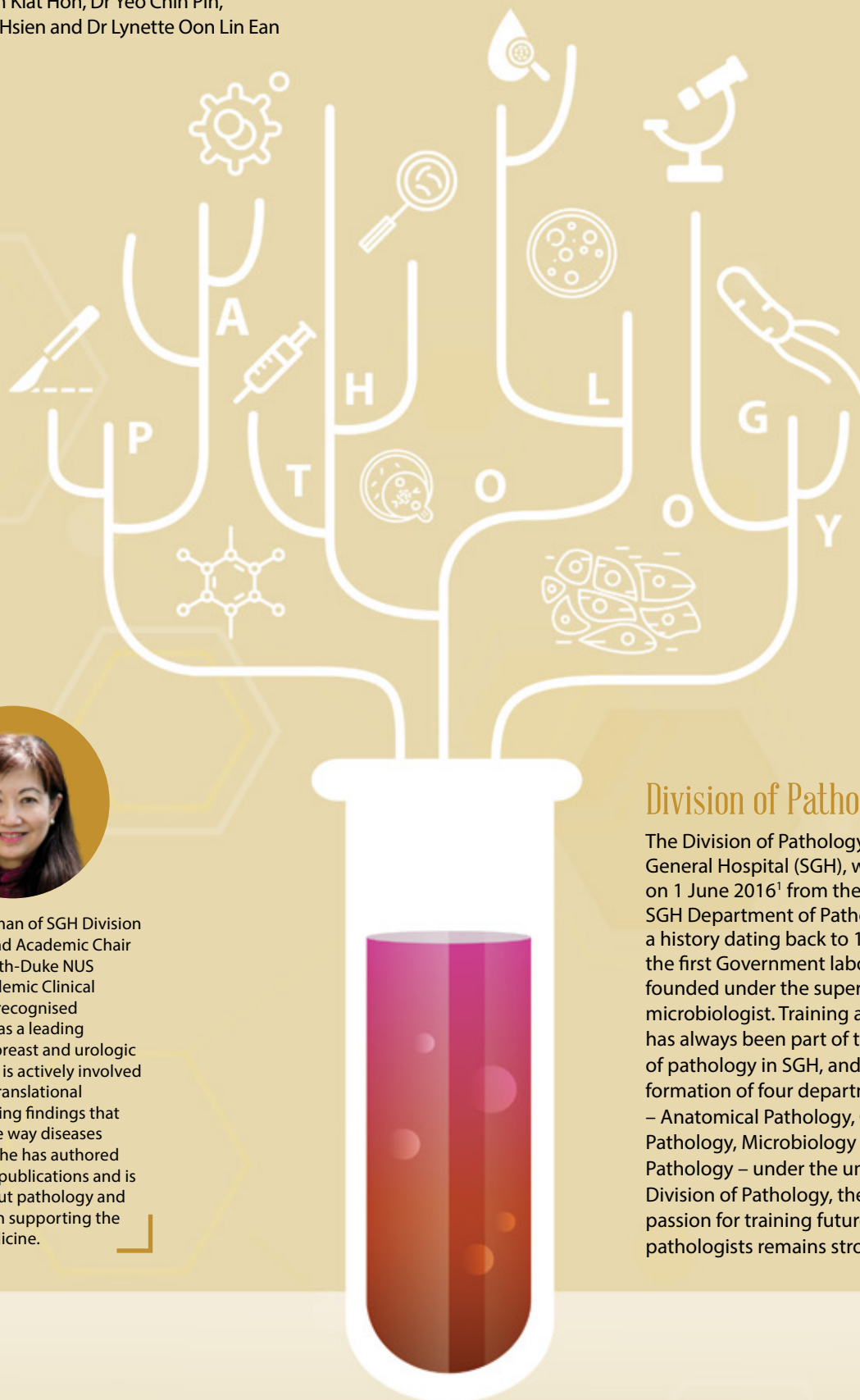


The Pillars of Pathology

Text and photos by Prof Tan Puay Hoon,
A/Prof Tony Lim Kiat Hon, Dr Yeo Chin Pin,
A/Prof Koh Tse Hsien and Dr Lynette Oon Lin Ean



Prof Tan, Chairman of SGH Division of Pathology and Academic Chair of the SingHealth-Duke NUS Pathology Academic Clinical Programme, is recognised internationally as a leading pathologist in breast and urologic conditions. She is actively involved in clinical and translational research, pursuing findings that may change the way diseases are managed. She has authored more than 400 publications and is passionate about pathology and its crucial role in supporting the practice of medicine.

Division of Pathology

The Division of Pathology, Singapore General Hospital (SGH), was formed on 1 June 2016¹ from the previous SGH Department of Pathology, with a history dating back to 1903 when the first Government laboratory was founded under the supervision of a microbiologist. Training and education has always been part of the essence of pathology in SGH, and with the formation of four departments – Anatomical Pathology, Clinical Pathology, Microbiology and Molecular Pathology – under the umbrella of the Division of Pathology, the spirit and passion for training future generations of pathologists remains strong and present.



A/Prof Lim is Head of the SGH Department of Anatomical Pathology. He is also the Academic Vice Chair, Strategic Programmes, of the SingHealth-Duke NUS Pathology Academic Clinical Programme. With keen interests in research and education, he directs many initiatives like the Translational Pathology Centre and is a core faculty for the Anatomical Pathology Residency.

Anatomical pathology

Anatomical pathology training in the SingHealth cluster is broad-based, emphasising clinical quality, system-based approaches and evidence-based practice. The main components in anatomical pathology are general surgical pathology and cytopathology. The programme covers all subspecialties with a system of rotations at SGH, KK Women's and Children's Hospital (KKH) and Changi General Hospital (CGH). Paediatric and gynaecologic pathology rotations are at KKH while CGH provides general surgical pathology training.

We currently have more than 40 faculty members with many years of experience, several of whom are examiners for both the UK and Australasian Colleges, and a constant stream of residents from first to fifth years.

Our new laboratory facility on Level 10 of the Diagnostics Tower of the Academia building is installed with new state-of-the-art facilities, including a digital pathology system that has a significant component dedicated to education.

Anatomical pathology training encompasses three years of Accreditation Council for Graduate Medical Education (ACGME) accredited residency and two years of senior residency. Autopsy training is carried out at the Health Sciences Authority for six months. Our surgical pathology training comprises

gross trimming, frozen section, general surgical and subspecialty pathology, histochemistry, immunohistochemistry, immunofluorescence, and electron microscopy. In cytology, both gynaecological and non-gynaecological areas use conventional and liquid-based cytology preparation techniques. We run a busy fine needle aspiration cytology clinic where residents are rotated to.

We have a graduated system of clinical responsibilities that ensures closely monitored training and supervision, with development of judgement and diagnostic acumen. At each stage of training, milestones are set and residents are expected to learn and strive to reach their full potential. Regular participation in multidisciplinary meetings, quality improvement projects and resident representation on clinical governance and curriculum committees encourage involvement and engagement in the learning environment, allowing development of management skills. Modules in laboratory management and informatics have also been included recently. Newer advances in molecular pathology are incorporated and include molecular oncology and cytogenetics at SGH.

In planning for the future, our programme has developed tracks for subspecialisation in both traditional organ-based anatomical pathology fields, informatics and molecular pathology.



Clinical pathology

With a workforce of over 200, comprising clinical biochemistry, satellite laboratories, client and specimen management and the blood bank laboratory, the Department of Clinical Pathology plays a significant role in SGH clinical services.

Offering a comprehensive repertoire of laboratory tests ranging from stat and routine tests of renal, liver, cardiac and respiratory functions, to highly specialised tests for hormones, tumour markers, trace metals, vitamins, and therapeutic drug monitoring, the Clinical Biochemistry Laboratory provides unique opportunities for young doctors to experience the fast-paced laboratory-clinical-care interface and work with state-of-the-art automated pre-analytical, analytical and post-analytical processes alongside leading-edge complex technology such as high performance liquid chromatography, liquid chromatography tandem mass spectrometry and inductively coupled plasma mass spectrometry.

The laboratory extensively employs information technology to ensure connectivity and to facilitate a seamless workflow for laboratory diagnostics and information delivery. Our medical laboratory scientists are adept in lean laboratory workflows, robust tests and devices evaluation, and laboratory operations with a keen eye on effectiveness and efficiencies in clinical service performance. Blood banking, off-site laboratory services to the SingHealth polyclinics and SGH campus, and outreach services supporting external client requests and specimen collection, give a level of completeness and appreciation of the laboratory framework.

Laboratory attachments, medical officer training and clinical fellowships are available. Over the years, we have hosted many students, medical trainees, and clinical fellows on short and medium duration postings, with both general and specific aims. Our Clinical Biochemistry Laboratory has also been accredited for chemical pathology training by the Royal College of Pathologists of Australasia (RCPA) and Royal College of Pathologists (RCPATH, UK).



With clinical interests in Chemical Pathology, Dr Yeo oversees the SGH Department of Clinical Pathology as Head, and co-chairs the Laboratory Quality Committee in SGH Division of Pathology. She is also Chair of the SGH Point-of-Care Testing (POCT) Committee, and Adjunct Assistant Professor at the Duke-NUS Medical School.

Microbiology

There is probably no branch of medicine that is as dynamic as clinical microbiology. SARS, Nipah, Ebola, H5N1, MERS-CoV, Chikungunya, Zika, Carbapenemase-producing Enterobacteriaceae, invasive Group B Streptococcus – these are just a few recent examples of emerging infectious diseases that have appeared in the mainstream media and captured the attention of the general public. Clinical microbiologists represent the frontline against microbial threats to human health. So what do we do and how do you become a microbiologist?

The route to microbiology training is designed to test the candidates' intelligence and resolve. Microbiology is not a residency programme! It follows the traditional Pathology Seamless Programme comprising five years of training. This means that you will not find it listed under the residency programmes on the Ministry of Health

Holdings website. Instead, you will have to keep an eye out for the Seamless Traineeship Call. As this is liable to change, my advice would be to talk to the microbiologists in your hospital and they can guide you through the application process.

The scope of microbiology training reflects the different roles of a clinical microbiologist, including laboratory diagnosis of infectious diseases, principles of antibiotic therapy, biosafety, infection control, public health and laboratory management.

A typical training programme will involve some didactic teaching, rotation through the various laboratory benches in bacteriology, mycology, virology, mycobacteriology and immunology/serology. External postings will often be arranged to microbiology laboratories in other hospitals, the Department of Infectious Diseases, the Infection Control Team, and the Communicable Diseases Surveillance Branch of the Ministry of Health, for further



A/Prof Koh is Head of the SGH Microbiology Department, and Academic Vice Chair, Research, in the SingHealth Duke-NUS Pathology Academic Clinical Programme. He is zealous in his pursuit of microbiology research, especially in antibiotic resistant microorganisms. While actively involved in research activities, he teaches microbiology trainees as well, instilling in them an investigative mind to pursue research realms in medical microbiology.

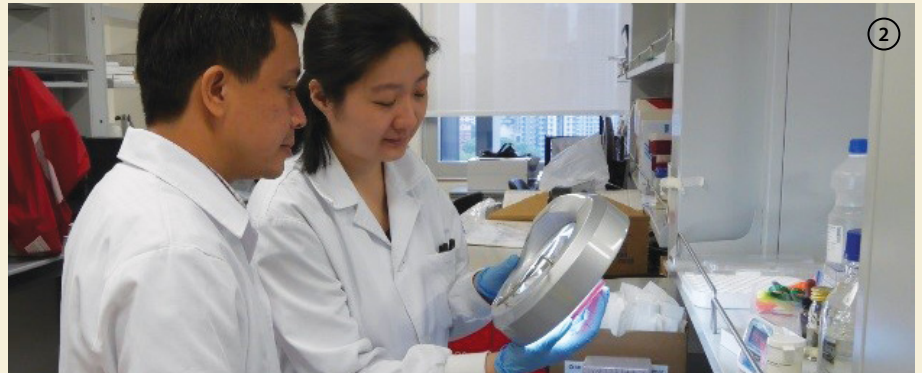
exposure. At present, most trainees sit for examinations with either the Royal College of Pathologists of Australasia or the Royal College of Pathologists (UK).

Apart from clinical service, there are also ample opportunities for education and research. You can get a good idea of our activities by visiting our social media platforms.

Blog: <http://10minus6cosm.tumblr.com/>

Facebook: <https://www.facebook.com/DiagnosticBacteriology/>

Twitter: <https://twitter.com/10minus6cosm>



Dr Oon, well respected in her field of expertise, is currently the Head of SGH Department of Molecular Pathology and Academic Vice Chair, Clinical Services at SGH Campus of the SingHealth-Duke NUS Pathology Academic Clinical Programme. She is also the President of the Singapore Society of Pathology and oversees the SingHealth Institutional Biosafety Committee.

Legend

1. Group photo with our pathology colleagues and medical students at the SingHealth Residency Open House 2016
2. Interpreting the growth of bacteria on agar plates is a fundamental skill for microbiology trainees

Molecular pathology

Molecular pathology is one of the newest disciplines in pathology and probably the fastest growing as well. It involves the study and diagnosis of disease through the examination of macromolecules, such as DNA, RNA or protein, in patient samples. Molecular pathology straddles other fields of pathology, such as microbiology, anatomical pathology and genetics. It is currently most commonly used in the field of clinical microbiology for the diagnosis of infectious diseases, monitoring of patients on antiviral therapy and in determining drug resistance in patients on antimicrobial therapy. It is also increasingly used in anatomical pathology for the confirmatory diagnosis of lymphomas, sarcomas and gliomas. Molecular pathology plays a very important role in personalised medicine, particularly in the field of oncology where the detection of mutations in different gene targets of the cancer allows the oncologist to tailor specific treatment for the patient.

The field of molecular pathology encompasses numerous techniques which are rapidly evolving. Current techniques include real-time polymerase chain reaction (PCR), multiplex PCR, in-situ hybridisation, DNA microarrays and DNA sequencing. The advent of next generation sequencing promises to revolutionise the practice of pathology, and bring molecular pathology to the forefront of medicine, especially in the field of genetics and personalised medicine.

Molecular pathologists in Singapore usually train in one of the “traditional” fields of pathology, such as microbiology or anatomical pathology, before subspecialising in molecular pathology as an associate consultant. They need to be meticulous, agile and responsive to rapid changes in technology, and will work closely with colleagues from a wide variety of clinical disciplines. There are also ample opportunities for research and collaborations with researchers in basic and translational fields. Molecular pathology will interest those with a keen inquiring mind and those with a love of new technology and challenges. ◆

Reference

1. Tan PH. The formation of the Pathology Division of Singapore General Hospital. *Proceedings of Singapore Healthcare* 2017; 26(1):3-4.