Celebrating 100 Years of NUS Anatomy (Part 1)

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Photos by NUS

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The National University of Singapore (NUS) Department of Anatomy commenced its centennial celebration earlier this year, marking its 100th year of establishment in Singapore.

NUS Anatomy: a history

First founded in 1905 as the Straits and Federated Malay States Government Medical School, the later named King Edward VII College of Medicine established the Department of Anatomy in 1922, chaired by Prof JG Harrower. The department started with an office, lecture theatre and dissection hall at the former female Lunatic Asylum, which was vacated during the Second World War. The anatomy infrastructure at Tan Teck Guan Building was only reopened in 1949, and subsequently introduced a histology and neuro-physiology laboratory, founded by Prof A Krishnamurti. New facilities were later opened, such as the Anatomy Museum, animal surgery OT, an animal perfusion room, a tissue culture laboratory and an animal house to keep animals involved in longer-term research. These facilities were key in training surgeons honing surgical skills and anatomists engaging in research related to animal models.

Throughout the last century, the Department of Anatomy has become an integral part in training all students in healthcare, involving medical, dental, nursing and allied health students, as well as trainees of various surgical specialties engaged in Continual Education Training (CET). Anatomy remains a cardinal pillar to the practice of medicine, relevant in every clinical problem, and forms the foundation of a medical student's career.

Anatomy education

The teaching of undergraduate medical anatomy today is broadly divided into three core topics:

1. The musculoskeletal system (upper and lower limbs);

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2. The thorax, abdomen, pelvis and perineum; and
3. The head and neck.

These themes include pre-laboratory didactic lectures, a prosection demonstration and a tutorial. Revisions in the pedagogy saw the introduction of Collaborative Learning Cases and Clinical Application of Medical Sciences, better known to the students as CLCs and CAMS respectively. These provided opportunities for realistic clinical problem-solving with practical application of anatomy and physiology.

Some key events that the department has held in the past include the Singapore Brain Bee Challenge, the International Anatomical Sciences and Cell Biology Conference, and the Asia Pacific International Congress of Anatomists.

Infrastructure in anatomy education

Emeritus Prof Ragunathar Kanagasuntheram worked with Mr Ayubi Berseh (a laboratory technician) to create and curate a series of specially dissected human specimens framed in plastic cases, purposed as long-term learning resources for medical and dental students. This grew to include normal and abnormal specimens; of note is a unique collection of normal and malformed fetuses, all of them labelled to aid better learning. These specimens can still be found at the NUS Anatomy Museum located at MD 11 Level 2, a familiar haven for students keen on revising structures that were taught during prosection classes.

The traditional approach to learning human anatomy during hands-on cadaveric sessions remains popular among students as a mode of knowledge acquisition. Being able to freely visualise from all possible angles – anterior, posterior, medial, lateral, superior, inferior – to picture and map the structures and organisation of the human body is a great boon. As cadavers gradually diminished in quantity, ten years ago, the Department of Anatomy gained the support of the National Organ Transplantation Unit, Ministry of Health to set up a body donation programme for medical and surgical education. Inspired by the model of Silent Mentors at the Tzu Chi College of Medicine, which focused on the humane treatment of cadaveric donations for medical education and research, Prof Bay Boon Huat and A/Prof Ng Yee Kong launched a Body Donation and Silent Mentors programme at NUS. Since then, annual appreciation ceremonies have been held to acknowledge the Silent Mentors for their selfless and noble contributions in enabling invaluable acquisition of anatomical knowledge through realistic cadaveric teachings.

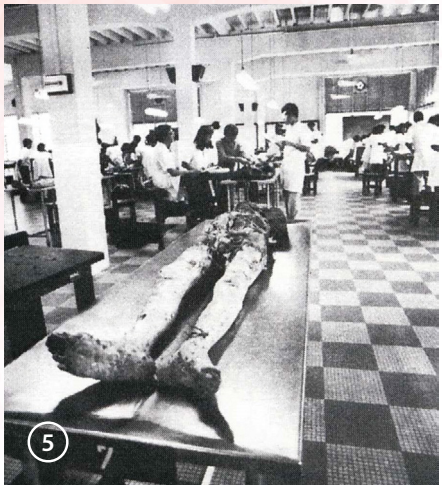
And so, the Silent Mentors continue to teach not only students at the undergraduate level, but also those in postgraduate training at CET courses on "Cadaveric Dissection for Residents". This training plays an important role in the upgrading of surgical finesse and competency in many emerging areas of surgery and helps to supplement training on complex procedures where real-life simulation is not ideal, considering potential risks intra-operatively. Surgical specialties that partner with NUS Anatomy include orthopaedic surgery, hand and reconstructive microsurgery, otolaryngology (ENT),

"The arrival of SARS in 2003 resulted in great difficulty in securing enough cadavers – also known as our Silent Mentors – for dissection during anatomy classes. Emeritus Prof Ling Eng Ang had great foresight in engaging master technicians to develop prosected specimens, which were most valuable in anatomy education, especially since students could not gather in large crowds during dissection sessions."

– Prof Bay Boon Huat, former Head of Department of NUS Anatomy

ophthalmology, plastic surgery, O&G, neurosurgery, oral maxillofacial surgery, cardiothoracic surgery and general surgery. Each of these specialties, especially general surgery, conduct one- to two-day workshops in partnership with NUS Anatomy.

In addition to traditional cadaveric education, efforts adapting to the technological advances and changing educational needs have set in motion various initiatives such as the recent digitalisation of the Anatomy Museum – resulting in the Virtual Anatomy Museum which offers virtual tours of cadaveric specimens and histology slides – "Mixed Reality" (Microsoft's HoloLens) and three-dimensional virtual dissection devices, namely the Anatomage Table.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Research

Over the past century, the Anatomy Department has made extensive contributions to the advancement of medical and anatomical knowledge through research. The department focuses on two main areas for research: neuroscience and cancer biology.

In the field of neuroscience, Prof Ragunathar Kanagasuntheram and his team had significant findings and publications on the innervation, ultrastructure and functional importance of anatomical structures in humans and primates. Emeritus Prof P Gopalakrishnakone is a pioneer of research on toxins and their effects on skeletal muscles and mammalian organs. Prof Ling EA and A/Prof S Thameem Dheen both have devoted interest in the field of microglia and have published notable works on international platforms.

The Cancer Biology Research Programme is overseen by Prof Bay BH, A/Prof George Yip Wai Cheong and A/Prof Chen Leilei, in order to support research in carcinogenesis and cancer progression. Prof Bay BH focuses on biomarkers in cancer and molecular-targeted cancer therapeutics while A/Prof Yip WC is interested in the functional significance of heparan and chondroitin sulfate proteoglycans in breast cancer. A/Prof Chen Leilei's lab delves into the transcriptome instability of human hepatocellular carcinoma.

Notable contributions by the heads of department

Prof JG Harrower (1922–1935) served as the first chairman of the Department of Anatomy. His research focused on the anomalies in the skull of the Hylam Chinese, Hokkien and Tamil populations, and his teaching was well liked by many. The students' lounge in the Medical College was named Harrower Hall to honour his contributions. Prof WA Fell (1936–1941) and Prof Alan Richmond Ellis (1949–1962) then succeeded his position and led the department through the pre- and post-war years.

Prof Ragunathar Kanagasuntheram (1962–1979) was the first Asian head of department who established the teaching and research facilities for the Anatomy Department. These included an animal house, an animal surgery suite, electron microscope facilities and the Anatomy Museum.

Prof Wong Wai Chow (1979–1992) also served as the head of department, and he is widely recognised for his research in neurodegeneration and neuroregeneration. He was succeeded by Prof Leong Seng Kee (1992–1998), who pioneered research in neuroplasticity and the role of nitric oxide in the nervous system.

Prof Ling EA (1998–2008) is a giant in the field of microglia research, and he is fondly remembered by his students for his unique teaching style using the "chalk and board" and "projector and screen". Profs Ling EA and Bay BH (2008–2016) further developed the Anatomy Museum into the modernised, exemplary resource centre it is now today. Together with A/Prof Ng YK, they initiated the Body Donation Programme in 2012 with the foresight to maintain sustainable anatomy teaching using cadavers.


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Most recently, A/Prof ST Dheen (2016–present) serves as the current head of department. He initiated the digital transformation of the department and set up CET surgical anatomy workshops for residents. ◆

The Anatomy Centennial Medical Bursary has been established in commemoration of 100 years of anatomy in NUS, in order to alleviate our students' financial burden while allowing them to focus on their studies and participate meaningfully in the school's programmes and community activities. A firm foundation year for these medical students is crucial in helping them succeed in their studies, and we would like to ensure that no student is left behind in their pursuit of quality medical education. More information is available at: https://nus.edu/3fClLq5.

Legend

1. Tan Teck Guan Building in 1969, the first Anatomy building at Sepoy Lines

2. Prof Kanagasuntheram passing the baton to Prof Wong in 1979

3. Prof Kanagasuntheram and Prof Ling in 1960s/70s

4. Prof Bay Boon Huat, former Head of Department of NUS Anatomy

5. Early Anatomy Hall at Sepoy Lines

6. Anatomy Museum at Kent Ridge before 2003

Celebrating 100 Years of NUS Anatomy (Part 2)

Interview by Joycelyn Soo Mun Peng and Helen Cai, Student Correspondents
Photos by NUS Department of Anatomy

This is the second article of a two-part series. Part 1 (https://bit.ly/5411-Insight) covers a snapshot of key historical developments in the Department of Anatomy, National University of Singapore (NUS). This article comprises interviews conducted by ***Joycelyn Soo (JS) and Helen Cai (HC)*** *with previous and current Heads of Departments (HODs) of the NUS Department of Anatomy –* ***Emeritus Prof Ling Eng Ang (LEA)****,* ***Prof Bay Boon Huat (BBH)****, and* ***Prof George Yip (GY)*** *– and an NUS medical alumnus and practising emergency medicine doctor,* ***Dr Darius Pan (DP)****.*

Emeritus Prof Ling Eng Ang attained his Bachelor of Science Degree in Zoology from the National University of Taiwan in 1966, his PhD from the University of Cambridge in 1970 and moved onto a postdoctoral fellowship programme at McGill University. In 1972, Prof Ling started at the NUS Department of Anatomy as a lecturer, teaching and training many batches of doctors and medical students since. During his time as HOD from 1998 to 2008, he made many notable contributions, one of which is developing the Anatomy Museum into one of the department's best learning resource centres.

Prof Bay Boon Huat began his journey in education as a senior tutor at the NUS Department of Anatomy in 1989, and he later became the HOD in 2013. During his time teaching at NUS, Prof Bay adopted a student-centred approach. He developed a handbook for pharmacy students and video demonstrations for pre-laboratory sessions. He uses a clinically oriented approach when imparting knowledge about anatomy and emphasises on building basic foundational concepts to medical students.

Prof George Yip is the current HOD of the NUS Department of Anatomy. He has been greatly involved in the education of students, being the coordinator of the Undergraduate Research Opportunities Programme in Science and Honours Project in Life Sciences (LSM4199), and his commitment to education excellence has been recognised by the NUS Annual Teaching Excellence Award and the Yong Loo Lin School of Medicine Faculty Teaching Excellence Award.

Dr Darius Pan graduated with honours from NUS in 2016 and is an emergency medicine doctor practising at the National University Hospital. He was appointed adjunct lecturer in Anatomy under the Clinician Educator Scheme in 2022.

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JS, HC: Hello Prof Ling, Prof Bay, Prof Yip and Dr Pan. Very nice to meet you and thank you all for your time today. We hope to commemorate 100 years of NUS Anatomy with this article, sharing the insights and reflections of our educators and former students at the NUS Department of Anatomy.

To start off with a question to our professors, what did you enjoy most about teaching at NUS Anatomy?

LEA: July 2022 marked 50 years since I joined the department. For me, the best part is when the students appreciate that we have taught them. Better yet is my attending doctors being appreciative when I go for my medical check-ups. In fact, I very much enjoy teaching. That's why I am still here at NUS. If I could teach as a hobby, I would feel blessed.

Dissection and the Silent Mentors

JS, HC: Thank you Prof Ling. We are most appreciative that our tutors in Anatomy are committed to education, motivating us with their passion for anatomy. We know that the department has been constantly improving its methods of education and have started new programmes over the years. One of these efforts is the Body Donation programme. How did that get started?

LEA: Let me introduce a bit of our history of using cadavers. We started off with using cadavers in the 1980s as we had a supply of cadavers from the Health Sciences Authority. Most were unclaimed bodies but the number of bodies started dwindling over the years. We could not afford having every student perform dissections, and another concern was fitting over 180 students in the dissection hall. Around the year 2003, we thought that one way to preserve the number of the cadavers would be to use prosections. We engaged staff from Kunming, China to prepare prosections for students' learning, which was called "exploratory learning" back in my time. However, the number of available cadavers was still declining until we started the Body Donation programme.

Currently, Year 1 students look at prosections and learn the anatomy. During the summer break, dissection is available as an elective for Year 1 students. Those who are keen to dissect can opt to come back for it, and the attendance has been quite good.

If you ask me, dissection is the way to learn anatomy – you learn by looking at the person. In Chinese, there is a popular saying, "百闻不如一见", and more recently, "百见不如动手", which means seeing once is better than hearing a hundred times, and getting into the action and doing is better than just seeing.

BBH: Prof Ling has actually revolutionised this whole aspect. We were very fortunate that he had the foresight in 2003 to shift to prosection. If we did not have all these prosected specimens during the COVID-19 pandemic, everything would have come to a standstill due to cadaver shortages.

The Silent Mentor programme was adapted from Tzu Chi University as we found the concept particularly good and applicable to Singapore's context. We wanted our students to appreciate their Silent Mentors when undergoing dissection sessions, and to engage in events post-dissections to show their appreciation.

DP: Back when I was a first-year medical student in 2011, the Silent Mentor programme was still in the developmental stages. Ten years later, as I return to the department to teach, many things have changed. Essentially, the cadaver is like our first patient. Through the Silent Mentor programme, we learn to show respect and appreciation for our patients, and this sets the tone which carries through to the next phase of our career from students to doctors.

New approaches to anatomy

JS, HC: With the rapid expansion of medical knowledge in the current era and with the changing responsibilities of doctors, how has the teaching of anatomy at NUS changed?

BBH: I think nowadays the approach is more towards practical application and knowledge. There is no point in learning all the individual branches for the arteries, but it is good to know the functions and significance of the blood supply. We are now more aligned towards clinical anatomy. You will find that our tutorial objectives are based on clinical scenarios and how you would apply what you have learnt. That is what I think students would benefit from the most when they go to the wards. They can relate the anatomy that they have learnt to what they are seeing; it does not make sense for them to just learn the anatomical structures by rote memory. This is also what medical schools around the world are doing.

LEA: When I first joined in the 1970s, the total number of anatomy contact hours were over 700 hours. It is now being gradually reduced to about 200 hours. To me, a great outcome from our many medical curriculum reviews is that we trimmed away a lot of the unnecessary details. If you look at our tutorial objectives now, you will see that they are much more functional, focusing on applied anatomy with clinical relevance.


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If not, you may end up memorising all the branches of the brachial plexus without knowing what their relevance is. For example, we have done away with all the cutaneous branches, and that knowledge is more than enough for most practising GPs. If the students want to become specialists, they can go into more detail later. We have also simplified the curriculum – retaining its essence while making the content more clinically relevant.

Nostalgic memories

JS, HC: We have heard about how life is like for educators at NUS Anatomy and were wondering if Prof Yip could share with us how it was like as a former student and now as an educator. Do you have any fond memories during your time as a student?

GY: Well, I do have this interesting story. For anatomy back in those times, Prof Rajendran would bring two 35 mm projectors to class. He was very artistic and used plasticine to make models for both gross anatomy and embryology teaching. By making use of both projectors, he would demonstrate the transition between layers and show us what happens if you remove each structure, and what lay behind. Using the same approach, he could also show changes in different parts of the embryo, such as how the midgut herniates out, undergoes rotation and goes back in again during gut development.

JS, HC: Dr Pan, could you share with us your fondest memory at NUS Anatomy?

DP: I remember when I was in Year 1, our seniors would tell us about the "Papa", "Mama" and "Baby" versions of the medical textbooks which differ by their thickness. As anatomy textbooks were very thick, I bought the "Mama" version. For convenience, I would cut the textbook into chapters and bring these to read on the train and into the lecture halls.

My fondest memory in anatomy is of the time I spent with my tutor, Dr Satish LR. We struck a very deep friendship over the past decade. He is the sort of tutor who encourages you to never stop learning. When we asked him questions which he did not have the answer to, he would take it as a learning point for himself and go on to investigate and return with answers during the next tutorial. I am thus inspired by him to never stop learning and to take every opportunity to further my knowledge.


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JS, HC: Agreed, Dr Pan. Anatomy is the first thing we get to know in medicine, and it sticks with us throughout our careers many years after we graduate.

To another 100 years!

JS, HC: Two final questions before we end the interview. What do you hope for the Anatomy department to achieve in the coming years, and do you have any well wishes or congratulatory words for the department?

DP: The evolving focus of anatomy will be on more intentional clinical application and its foundational role in clinical practice. In future years, we will also move towards a more systems-based approach in teaching anatomy.

The NUS Department of Anatomy has been a long-standing institution and its heritage can be traced back to the pre-war era. I congratulate the department on the past 100 years, and hope that the department can continue to impart important knowledge to future generations of doctors and students.

GY: The department has come a long way since it was established. The NUS Anatomy department has been recognised as one of the leading institutions in Asia. Moving forward, we would like to build on this and become even better not just in Asia, but also in the global arena.

LEA: Our primary aim is really to teach our students well. As one of our vice-chancellors used to say, "teachers exist because of students".

JS, HC: Thank you all very much for your time today, and for sharing with our readers. We congratulate NUS Department of Anatomy on their centennial celebration! ◆

For the full interview, please visit https://bit.ly/5501-Interview or scan QR code.

Legend

1. Modern Human Anatomy Museum

2. Medical students observing a moment of silence for their Silent Mentor

3. Cadaveric dissection workshop for surgical residents

4. Exchange students learning at the Human Anatomy Museum

Joycelyn, student correspondent (Singapore) at *SMA News*, is almost at the end of her fourth-year as a medic at the National University of Singapore. She is passionate about teaching and writing, and is an avid swimmer in her free time.

Helen, student correspondent (UK) at *SMA News*, is a second-year medic at the University of Cambridge. She is a huge animal lover and enjoys playing the drums and indulging in theatre in her free time.