

ANATOMICAL DISSECTION:

EXPERIENCES AND EDUCATION

Text by Nicholas Loh

Introduction

What comes to mind when you hear the words “anatomy” and “dissection”?

If you had asked me this question in the not-so-distant past (perhaps two years ago), I would likely have answered: “dealing with bones, muscles, cadavers and a ton of rote memorisation”. The unusual smell associated with formaldehyde-preserved cadavers is known to make some people queasy. Some find the experience of dissecting a cadaver emotionally challenging for personal reasons. On the other end of the spectrum, budding surgeons or anyone with a great interest in human anatomy may look forward to every dissection opportunity!

A Google search on “define anatomy” would yield the following definition among others: “the branch of science concerned with the bodily structure of humans, animals, and other living organisms, especially as revealed by dissection and the separation of parts”.¹

While such a definition is relatively straightforward, the etymology of “anatomy” is not so clear-cut. For this article, we shall consider the relevant etymology from Lexico.com.¹ In Greek, the “**ana-**” prefix means “up” (eg, **anabolism** – the building-up aspect of metabolism), while the suffix “**-tomy**” means “cutting” (eg, **appendectomy**, **mastectomy**, **pancreatectomy**). Thus, the word “anatomy” may be linguistically parsed and reconstituted to yield “cutting up”.

First dissection

In 2020, I underwent six anatomical dissection sessions. Medical students were organised into groups of about a dozen. Each group was allocated a fresh cadaver and would use the same

cadaver throughout their pre-clinical years. Every Wednesday, we would commence dissection on specific regions of the body as outlined by the dissection booklets. We would then have seven days until the next session to complete the required dissection. We could visit the anatomy laboratory for most of the week (usually in smaller subgroups of two to three) to continue the dissection progressively.

At the next session, members of each group are randomly selected by the anatomy professor and may be tested on the relevant anatomical knowledge (eg, origins, insertions, arterial blood supply, lymphatic drainage and nervous innervation; bone parts, surfaces and landmarks). They are expected to answer confidently in front of their peers.

The professor takes this exercise seriously. I remember vividly what he told us during the first anatomy dissection session: that the cadavers we were working with were sacred. After all, having a cadaver to dissect is a privilege, not an entitlement. The onus is on us to learn as much as we can from these dissections. It was almost as though he felt that we would be collectively doing the cadavers a disservice if we did not treat this anatomical study with the utmost respect. Given the responsibility to ensure that we would indeed be well-acquainted with the relevant anatomical content, weekly quizzing was thus no surprise.

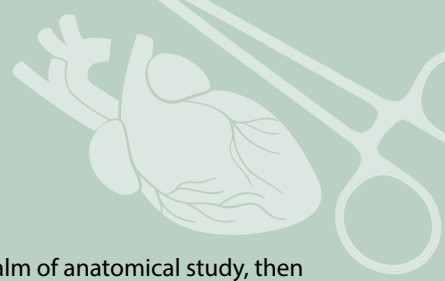
The cadaver which my group was allocated was somewhat obese. One lesson that we soon learnt was that we should be cautious in making hasty assumptions. Upon inspection of the face of our assigned cadaver, we had thought that our cadaver was male. When we saw the non-trivial amount of



bilateral mammary tissue, we thought that perhaps one of the issues that our silent mentor had previously faced was gynecomastia. However, when we later examined the pubic region, we concluded that it was much more likely that our cadaver was female.

Another lesson that I had learnt was how each cadaver is unique. This is something that most of us probably appreciate intuitively and abstractly. However, the uniqueness of each cadaver can indeed be quite striking when one executes the dissection. Anatomical diagrams in atlases and various anatomy education resources often provide the most common variants or idealised representations of anatomical structures and relationships. While this decision is understandably a pragmatic one, being fixated on just the most common anatomical variants without considering each cadaver’s unique profile could be the recipe for a great surprise when doing actual dissection. For our group’s cadaver, I remember being quite surprised when I saw how thin the pectoralis major was (yes, thin). It was only about 2 mm, a far cry from the classic depiction of a thick pectoralis major. Another surprise for me was how narrow our cadaver’s cephalic vein was.

Regarding anatomical variations, a cadaver that belonged to another group was found to have a sternalis muscle.



Its presence is a relatively uncommon anatomical variant. Even for this muscle itself, there exists a great amount of variation in its characteristics. For example, it may manifest as a few relatively short fibres, a well-defined muscle, or even either unilaterally or bilaterally!²

Anatomical variants are not necessarily mere nice-to-know factoids. In the case of the sternalis muscle, there seems to be a decent amount of clinical relevance: early detection is ideal in a typical mammogram screening to avoid differential diagnostic challenges! Moreover, the sternalis muscle itself may also be beneficial as a flap in reconstructive surgery of the head, neck, anterior thoracic wall and breasts.²

Anatomical education in medical schools

Globally, anatomical education has evolved in pace with the rapid advancement of technology. On the Apple App Store, users are greeted with an array of anatomy education apps (eg, Complete Anatomy 2021, Essential Anatomy 5). There are also YouTube channels dedicated to anatomy content (eg, The Noted Anatomist, AnatomyZone, 3D4Medical). This is in addition to the classic anatomy books that students can use (eg, Netter, Rohen, Moore). The evolution of anatomical education has not just manifested at the individual level. Whole institutions have also had to adapt when faced with cadaver shortages. Being able to anticipate change and stay relevant by adapting to alternative modes of education will be more important than ever given the ongoing COVID-19 pandemic.

Fundamentally, there has been a shortage of cadavers in Singapore. In response to this, the three local medical schools, the NUS Yong Loo Lin School of Medicine (NUS Medicine), Lee Kong Chian School of Medicine (LKC Medicine) and Duke-NUS Medical School (Duke-NUS) have had to modify their take on anatomical education accordingly.

LKC Medicine obtained an Anatomage Table for virtual dissection in 2013. The virtual dissection table allows students to use a virtual blade to remove tissue layers and view the body's visceral structures.³ Moreover, LKC Medicine employs the use of plastinated bodies,

which are cadavers preserved with plastic. Unlike traditional cadavers, these plastinated bodies are more durable, allowing for greater cadaver longevity (ten to 15 years). However, delicate structures such as nerves may still break easily after repeated handling.⁴

As for NUS Medicine, dissection classes were halted in 2003 when there was a shortage of cadavers. In a stroke of serendipity, anatomical dissection resumed in 2016 (albeit in the form of an elective) due to a surge in the number of donated bodies to the school. In 2017, no fewer than 20 bodies were bequeathed to the medical school's anatomy department. Besides body donation, cadavers are also obtained when bodies are unclaimed. The latter constitutes NUS Medicine's traditional source of cadavers.⁴ To date, students and faculty of NUS Medicine organise and participate in annual appreciation ceremonies for these silent mentors out of respect and gratitude to the selfless individuals whose bodies have imparted invaluable anatomical knowledge.⁵

Anatomical teaching at Duke-NUS employs the use of radiological imaging, bones and plastinated models. Nevertheless, despite these technological adaptations, A/Prof Ng Yee Kong, coordinator of the Silent Mentors programme which commenced in 2012, said that using "human bodies is still the best because that's as real as it gets".⁴ Readers may be interested to learn that last January, Duke-NUS held its Donor Memorial, where students honoured their silent mentors with flowers, art, poems and cards.⁶

Traditional anatomy books

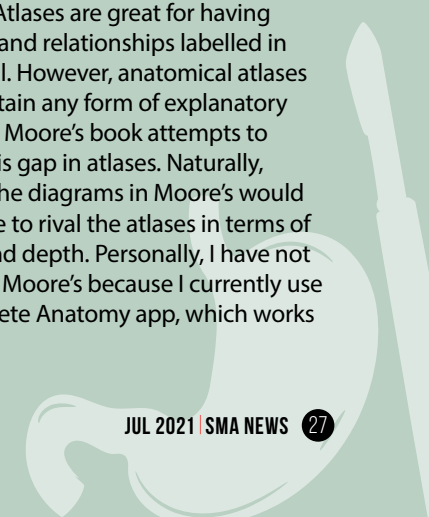
It is easy to feel that one is "missing out" if one has not had an opportunity to engage in dissection. However, as mentioned earlier, technological advances are enabling us to bridge the gap as best we can, in the absence of having cadavers to dissect. In this section, I would like to talk about some highly recommended anatomical hard copy resources which many students use. If you are unsure about what anatomy text to use, or if you have no idea what the commonly used names such as Netter, Rohen and Moore mean

in the realm of anatomical study, then you have come to the right place!

Firstly, no discussion on anatomy texts is complete without talking about Netter's. The late Dr Frank Netter was both a medical surgeon and a medical illustrator. Incredible, isn't it? Netter's *Atlas of Human Anatomy* is now in its seventh edition, and prides itself as the "only anatomy atlas illustrated by physicians". In addition to Netter's original illustrations, the atlas also contains nearly 100 paintings by Dr Carlos AG Machado, one of today's foremost medical illustrators. Together, the two physician-artists accentuate the most clinically relevant views of the human body.⁷ The illustrations and paintings in Netter's *Atlas of Human Anatomy* are highly regarded and have become the gold standard in anatomical education.

However, unlike actual cadavers, Netter's beautifully colour-coded illustrations may be "too perfect", and may not offer the learner the required dose of reality. As such, a wonderful complement to Netter is Rohen's *Color Atlas of Anatomy*. One purchase that I am particularly proud of was that of an older edition of Rohen's photographic atlas. I had purchased it during a university library clearance sale in 2018 for just \$2! Instead of containing hand-drawn illustrations, Rohen's atlas contains detailed photographs of different aspects of a dissected cadaver, each labelled appropriately. Rohen's unique approach of having a photographic atlas is not surprising. After all, it is highly unlikely that any other atlas can even come close to Netter's, at least in the realm of illustrated atlases. As such, Rohen's has carved a niche of its own as a photographic atlas.

Lastly, another resource I would like to talk about is Moore's *Clinically Oriented Anatomy*. Atlases are great for having structures and relationships labelled in great detail. However, anatomical atlases barely contain any form of explanatory text, if any. Moore's book attempts to address this gap in atlases. Naturally, however, the diagrams in Moore's would not be able to rival the atlases in terms of breadth and depth. Personally, I have not had to use Moore's because I currently use the Complete Anatomy app, which works



well for me. My advice is to find out what works for your specific circumstances!

Conclusion

Being part of a group that has been entrusted with dissecting a fresh cadaver has been an incredibly humbling experience. We must indeed be grateful to our incredible silent mentors who have generously bequeathed their bodies for the advancement of medical education and research. If we consider the entire recorded history of anatomy, we would realise that the widespread notion of obtaining consent for body donations is a relatively modern one. There was a time when human dissection was prohibited, when people would exhume graves and sell the corpses to anatomists to meet the great demand for cadavers. How far we have come.

For those among us who do not currently have the opportunity to learn

from the physical anatomical dissection of cadavers, we ought to make full use of the myriad of learning resources available to us. These could be at the individual level (eg, online videos, educational apps, traditional anatomical textbooks and atlases) and/or at the level of our educational institutions (eg, plastinated models, radiological imaging, cutting-edge virtual dissection tables). ♦

Prior to his transfer to NUS Yong Loo Lin School of Medicine, Nicholas was an overseas medical student. For leisure, he enjoys reading and playing the piano.



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