

The anatomy of anatomy

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Abstract: The relationship between anatomy and surgery has been historic and epic, spanning many centuries, complementing each other in medical education and being independent as well as interdependent in many ways. However, curricular changes that have happened globally in recent years with the introduction of several contemporary styles of medical teaching have subtly downplayed the importance of anatomy in medicine, allowing young doctors with poor knowledge of anatomy to become surgeons. With a whimsical introduction that metaphorically hints at the strained relationship that exists between anatomy and surgery, the article attempts to explore the 'anatomy' of anatomy itself, examining its origins in recorded ancient history, evolution along the centuries in tandem with surgery and its current status in medical education.

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When Anna Tomei and her husband were ushered into my consultation room, my first reaction was one of surprise, since contrary to what I had expected, the woman looked very young, amazingly pretty and had the most beautiful appearance that belied her age. Sir Jerry, her handsome husband, appeared smart, sharp and confident, but I could sense some emotional distance and a troubled relationship between them both.

It was Anna who spoke first. She admitted that she was much older than her husband, but nevertheless insisted that she had been the foundational base for his development and success. She showed no embarrassment or hesitation in mentioning that historically, several men had found her fascinating, most of them taking her apart to understand her inner beauty in greater detail. I could sense an egotistical conflict when Sir Jerry argued that while Anna did play an important role in making him what he is today, his success was largely due to his newly found associates Ima Jing and Teck Nol Ojie who

assisted him intimately in his practice, helping him make accurate diagnoses and enabling him to operate with precision. The heated debate between the couple continued for what seemed to be forever. It was only then that the alarm clock went off.

I woke up with a start to realise that this was a curious dream conjured up by the imaginative grey cells of the brain, metaphorically representing the archaic and epic relationship between anatomy and surgery, which has not only been historical, but also a solemn bond that has stood through the ages. Anatomy, which preceded surgery as a discipline has always been the foundation and also the fascination for all surgical disciplines. However, the knowledge explosion and the great technological advances (particularly in imaging and endoscopic techniques) that have happened in the last few decades seem to have somehow subtly shifted the emphasis away from sound instruction and understanding of human anatomy in the recent past.

According to Older (2004)¹ the teaching of anatomy to both undergraduate medical students and medical graduates is in the midst of a downward spiral. The traditional anatomy education based on topographical structural anatomy (taught by didactic lectures and complete dissection of the body with personal tuition) has been replaced by a multiple range of special study modules, problem-based workshops, computers, plastic models and many other teaching tools. Many medical schools have dispensed with cadaver/dissection-based teaching of anatomy. However, such changes to the undergraduate medical curriculum seem to have taken place without any research into the key aspects of knowledge necessary or comparing methods of teaching. As a common core curriculum is hardly ever present at a national level in many countries, new curricula have blossomed without external audit or validation. Institutional and academic autonomy empowers medical schools to teach and assess their own work themselves. The reduction of anatomy teaching ranges from simple to significant from school to school, but published data on the impact of these changes is scant. The reduction

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in undergraduate teaching and knowledge of anatomy has triggered great concern, not only for undergraduates but also to postgraduate students, especially in surgery. Reports of surgical errors continue to be on the rise, and these have been partly (if not entirely) attributed to poor anatomical knowledge. The changes in basic surgical training and a general de-emphasis on core anatomical knowledge seem to have created a system that is now allowing young doctors with a poor knowledge of anatomy to become surgeons.

Reduction in anatomy teaching (coupled with a few other factors) concomitantly led to the reduction of qualified clinical teachers of anatomy. Distinguished clinical anatomist and surgeon Professor Harold Ellis, declared as early as 1994 that dedicated clinical teachers of gross anatomy were at a premium as the significantly lower pre-clinical pay scales are a strong disincentive against medically qualified staff from teaching pre-clinical subjects². This statement, however, has been debated since some feel that it is not the lower pay, but the lack of opportunities that deters doctors from taking up a career in anatomy. Ellis believed that the time has arrived to overcome this shortage by renewing the association between surgeons and anatomical teaching and urged university surgeons to once more take part in the teaching of anatomy as was the custom and tradition in yesteryears. Furthermore, he observed that with the ever-increasing emphasis on research output and the ability to raise external research funds, the status of the academic *teacher* has been degraded. Today, the successful academic anatomist must have a high standing in his research field, and generate large research funding; his contribution to teaching is often little more than a token, in only one or two areas of anatomical science. Older¹ holds similar views and recommends that the dominance of research must be reassessed to establish an equitable cohabitation with teaching and the place of basic science, especially anatomy in basic surgical teaching, must be examined.

History shows that anatomy and surgery evolved together, just as anatomy of the nervous system and

neurosurgery developed in tandem. The London Medical Dictionary³ describes them as sciences of a rude war-like race, each very early cultivated. The Egyptians (with whom the roots of early medicine are always associated) were well acquainted with the structure of the body from their perfected practice of embalming. Embalmers were skilled in surface anatomy of underlying organs and hence capable of eviscerating organs through tiny holes and slits in the body. Ancient Greece is known to have liberally appropriated principles from Egyptian wisdom, sometimes masquerading them as their own. However, we only have the work of Hippocrates to estimate the state of anatomy and surgery in ancient Greece. Although his anatomical descriptions were based on animal dissections that were interpolated to humans, many were accepted as genuine. His surgical skills were comparatively superior, having opened abscesses, draining effused fluid from the thorax and abdomen and performed cranial burrs with the trepan for cerebral decompression. His chief surgical operation was the cautery which he recommended for a variety of diseases. Greek doctors and scientists were not particularly interested in anatomy since dissection was forbidden and funeral practices centred around cremation. The notable exception seems to be the philosopher and biologist Aristotle who taught comparative anatomy of animals with large diagrammatic illustrations.

Advancements in anatomy and surgery continued to happen in the centuries that followed through distinguished professors like Herophilus and Erasistratus in Alexandria who were anatomists and practising surgeons. Alexandria permitted public dissection of convicted criminals, alive and dead, purposefully to horrify as much as instruct. With good anatomical knowledge and surgical skills, they described lymphatic lacteals, meninges and also performed laparotomies and lithotomies. But it was not until the advent of Claudius Galenus (or Galen) that the next significant anatomical era commenced. Galen was a diligent dissector and documented his extensive findings and knowledge of anatomy. He is said to have kept more than a dozen

scribes busy recording his anatomical observations and case histories. He also performed vivisections on animals and furthered his knowledge of anatomy and practice of surgery at the arena and battlefields treating wounded gladiators and soldiers. However, Galen possessed arrogant and authoritative charisma that was almost dictatorial and anyone who dared to challenge his views was bludgeoned to submission by his extremely powerful gift of the gab. As a result he dominated medical thought far into the 16th century.

In the Middle Ages, Arabian surgeons Rhazes, Avicenna, Avenzoar and Abu al-Qasim al-Zahrawi (also known as Albucasis) contributed improvements to surgery with anatomical knowledge acquired from the works of Hippocrates and Galen. Albucasis developed a complete system of surgery. He is also considered the first to have introduced arterial ligation, although this improvement is often erroneously attributed to Ambrose Paré. Both anatomy and surgery were at low ebb in the several years that followed with very few names emerging that are worthy of mention.

Anatomy in the sixteenth century dawned with Sylvius. Vesalius was his pupil and an ardent anatomist. When he exposed the errors of Galenic descriptions and teachings, the frenzy that it created was of such magnitude that even denying the infallibility of Vatican's head would have been considered comparatively a pardonable crime. The anatomy of Vesalius, as described in *De Humani Corporis Fabrica*, however, was of interest and value with accurate descriptions by the author and masterly drawings from the versatile Titian. Considered one of the most influential text books of anatomy ever written, the *Fabrica* had seven volumes with many diagrams depicting human anatomy from skin to skeleton making it an object of veneration. The Renaissance era, which was an artistic and intellectual awakening that coincided with the re-examination and re-appreciation of ancient wisdom, also saw artists engaging in anatomy for accuracy and authenticity of their paintings and sculptures. The great painters of that time like Raphael, Titian and

Leonardo da Vinci were all excellent anatomists. Significant contributions were also made from Bartolomeo Eustachius (who described the adrenals, venae cavae, sympathetic ganglia and the pharyngo-tympanic tube that bears his name) and Gabriele Fallopius (who described the inner ear, cranial nerves and more importantly the uterine tube that was missing in the *Fabrica*).

The anatomy of the sixteenth-seventeenth century, had very little to do with bedside medicine, with anatomists concentrating more on discovery and artistic portrayal of the human form. Structure was not related to disease. In the early seventeenth century, it was physiology (rather than medicine) that found applications for anatomical research. For example, it is believed, that Harvey's discovery of blood circulation relied heavily (if not entirely) on his teacher Fabrizio's demonstration of the valves in the veins. Several prominent names are associated with the seventeenth century, but they are hardly distinguishable as anatomists and surgeons. Horatius, Bartholine, Schneider, Glisson, Wharton, Willis, Nuck, Malphigi, Bellini were some of the great anatomists-cum-surgeons of their time with whom many anatomical structures are eponymically named and associated till this day.

By the eighteenth century anatomical studies through dissection had secured a respectable position in the society. Sensualism – a newly evolved philosophy of that age – believed that all wisdom came from observation through the senses and anatomical studies fitted well with this new tradition. Rembrandt's famous painting of Dr Tulp teaching his students is a good example of how important anatomical studies were considered at that time to have been the subject of a maestro's work of art. In tandem, wax modelling also became an important tool of education, with elegant dissections and wax reproductions being preserved in museums for future reference. The Hunterian Museums in London and Glasgow are among many such museums which have spectacular collections of dissections and waxes from the ages past.

Sir Charles Bell (an early nineteenth-century artist, anatomist, surgeon and teacher after whom Bell's palsy is named) rediscovered that anatomy and art as closely related⁴. Bell considered the relationship between art and anatomy/surgery as multifaceted. Being a talented artist himself, Bell taught anatomy to artists as well as surgeons at the Great Windmill Street School of Anatomy, founded by John and William Hunter in the mid-eighteenth century. The contributions of William Hunter and his brother John Hunter in England need special mention and remain special till this day. William Cheselden, an anatomist-turned-surgeon, devised new methods for lithotomy and for iridectomy to create an artificial pupil for blindness. John Hunter, his student was a brilliant surgeon and an excellent anatomist who ran a surgical practice and a private school of anatomy in London. He inspired many including Sir Astley Cooper, another skilled anatomist who wrote on fractures, breast disease and hernias while he experimented with vascular procedures on dogs. In Scotland, the first Monro was an anatomist and surgeon of unrivalled excellence. The second Monro and Meckel perfected the discovery of the third distinct system of vessels, namely the lymphatics. Italy contributed its share of reputed anatomists in the form of Morgagni and Valsalva. However, these were only some of the noteworthy names. The global list of anatomists and surgeons of the last few centuries and their contributions towards medicine would be too lengthy for this review.

Historical thoughts and reflections, like diseases, can be both hereditary and communicable. Periodic glances at the rear-view mirror are imperative for safe driving; periodic glances of medical history and introspection from errors and achievements makes a safe physician, giving not only insight, but also warnings for the medical profession that need to be taken heed of. History has revealed that anatomy has evolved over the centuries with societal perspectives and academic approaches towards its instruction changing with time. Nevertheless, anatomy has always had a very close relationship with surgery that should neither be strained

nor severed. Social stigma associated with cadaveric studies are largely removed now with more and more people willingly leaving their bodies to science in what is considered as socially acceptable charity. In the late twentieth century, with the development of organ transplantation, donations are actively promoted by governmental and public agencies. Such donations are received with thanksgiving and respect by medical schools and hospitals. Plastination – an innovative technique introduced by Gunther von Hagens of Germany in 1979 – revolutionised preservation of tissues and body structures by permanently impregnating them with synthetic resin. Plastinated products are odourless, non-toxic and almost indestructible which remain intact for several decades, and the technique is currently replacing formalin embalming and cryopreservation in many medical schools. 'Body World' exhibitions of realistic plastinated corpses held by von Hagens in major cities like London have been claimed to educate through aesthetics and demystify the body in health and disease. However such grand public displays have also elicited mixed responses from the public ranging from horror to fascination and provoked a lot of ethical comments and controversies.

Terrestrial life and professional careers eventually end in death. But for medical students, life as a doctor and a career in medicine begins with death, often studying anatomy with the cadaver as the very first patient. It is an early encounter with mortality. It distinguishes doctors from others. Fearfully commencing anatomical dissections as timid rabbits, they progress into pathology understanding aortic dissections and eventually evolve as brave lions competent to perform complex surgical resections. The student-cadaver-patient encounter is paramount in medical education. In the words of Jacalyn Duffin⁵, the study of anatomy is a symbolic rite of initiation that socialises members into a professional tradition. It should be early in the medical curriculum, integrated, contextual and above all, be clinically and surgically orientated. Caution needs to be exercised during curricular revisions not to indiscriminately

reduce anatomy instruction, but allow the adequate and appropriate study of anatomy by classical methods, with relevant supplements of contemporary instructional methods. The flame of learning anatomy that has burnt bright over the past two and a half millennia since Herophilus and lit the paths of many a surgeon and anatomist along the centuries will then continue to light up the career paths of junior doctors and aspiring surgeons. As rightly pointed out by Older¹, extinguishing this flame by new educators in their quest to be modern would send anatomy into a dark abyss and result in a lower standard of care for our patients and problems.

REFERENCES

1. Older, J. Anatomy: A must for teaching the next generation. *The Surgeon* April 2004; 2: 79–90.
2. Ellis H. The Surgeon as a Teacher of Anatomy. *Clinical Anatomy* 1994; 7:156-161.
3. Bartholomew Parr. *The London Medical Dictionary* Vol. 1. 1809.
4. “The Beauty of Anatomy: The Art of Teaching Surgery in Early Nineteenth-Century London” – The March 2012 Malloch Circle Lecture and Reception
5. Jacalyn Duffin. *History of Medicine – A Scandalously Short Introduction*. Second Edition. University of Toronto Press Incorporated 2010.