



REVIEW ARTICLE

Anatomy As A Time Tested Speciality but A Forsaken Career Choice

Wajid Ali Chatha*

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Abstract: Anatomy is as old as humanity itself. The curiosity to learn about the body has led to the growth evolution and diversification of anatomy over time. The subject has grown from a study of human structure to encompass the fields of immunology and microanatomy.

Although anatomy has grown from a single subject to a combination of many subjects over the years, its diversification has failed to attract medical professionals to join it and take it up as a career. A review of the literature of around three decades was done in an effort to see what transitions the subject has faced. The subject has stood the test of time and more recently during the recent Covid-19 pandemic, where it was one of the subjects that could be efficiently communicated to the students in a smart way making use of modern technologies and animation.

Despite its grave importance, the subject is being manipulated at will by the medical institutes world over. This is happening in the absence of input from the faculties and at the expense of the allocation of its time and space to other subjects of the medical sciences. It is debated that no physician can claim mastery of medicine without having a proper working knowledge of anatomy. There is a need for a uniform curriculum of anatomy at least at the national level. Anatomical associations and regulatory bodies of the countries can play a positive role to prevent the decline of a subject that is one of the building blocks of medical sciences.

Keywords: Anatomy, Subject, Career, Covid-19, Omics, Curriculum, 3D.



*** Corresponding Author:**

Assistant Professor of Anatomy, College of Medicine, Northern Border University, Saudi Arabia.

e-mail: drchatha@gmail.com & Chaudhary.chatha@nbu.edu.sa



المملكة العربية السعودية
جامعة الحدود الشمالية (NBU)
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بحث مرجعي

علم التشريح تم اختياره عبر الزمن كتخصص ولكنه خيار مهني مهجور

واجد على شتا*

(قدم للنشر في 1444/4/7؛ وقبل للنشر في 1444/8/1هـ)

مستخلص البحث: علم التشريح قديم قدم الإنسانية نفسها. أدى فضول التعرف على الجسم إلى تطور النمو وتنوع علم التشريح بمرور الوقت. نما الموضوع من دراسة التركيب البشري ليشمل مجالات علم المناعة وعلم التشريح المجهرية. على الرغم من نمو علم التشريح من موضوع دراسي واحد إلى دمج العديد من الموضوعات الدراسية على مر السنين، فقد فشل تنوعه في جذب المهنيين الطبيين للانضمام إليه واعتماده كمهنة. تم إجراء مراجعة للأدبيات التي تعود إلى ثلاثة عقود تقريباً في محاولة لمعرفة التحولات التي واجهها هذا الموضوع. لقد صمد الموضوع أمام اختبار الزمن ومؤخراً خلال جائحة Covid-19 الأخير، حيث كان أحد الموضوعات التي يمكن توصيلها بكفاءة للطلاب بطريقة ذكية باستخدام التقنيات الحديثة والرسوم المتحركة.

على الرغم من أهميته الخطيرة، يتم التلاعب بالموضوع حسب الرغبة من قبل المعاهد الطبية في جميع أنحاء العالم. يحدث هذا في غياب مدخلات من الكليات وعلى حساب تخصيص وقتها ومساحتها لمواضيع أخرى من العلوم الطبية. تمت مناقشته في أنه لا يمكن لأي طبيب أن يدعي إتقان الطب دون أن يكون لديه معرفة عملية مناسبة بالتشريح. هناك حاجة إلى منهج موحد للتشريح على الأقل على المستويات الوطنية. يمكن للجمعيات التشريحية والهيئات التنظيمية في البلدان أن تلعب دوراً إيجابياً لمنع تدهور موضوع يعد أحد اللبنة الأساسية للعلوم الطبية.

كلمات مفتاحية: علم التشريح، موضوع دراسي، مسار مهني، كوفيد-19، جزء من التكنولوجيا الحيوية، منهاج دراسي، ثلاثي الأبعاد.

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للمراسلة:

أستاذ مساعد التشريح، كلية الطب، جامعة الحدود الشمالية، عرعر، المملكة العربية السعودية.

e-mail: drchatha@gmail.com & Chaudhary.chatha@nbu.edu.sa



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1. INTRODUCTION

Anatomy is deemed the oldest scientific discipline of medicine. The first documented scientific dissections on the human body were carried out as early as the third century B.C. in Alexandria (Ghosh, 2015). At that time, anatomists used to explore internal mysteries of human structure through dissections of animals, primarily pigs, and monkeys. The quest and curiosity to know about the human machine are as old as humanity itself. In 1762, France was the first country to establish veterinary medicine as a scientific discipline and that led to the evolution of human anatomy. That may be a reason that Anatomic models constructed and transmitted over the world by the French physician Louis Thomas Jérôme Auzoux (1797-1880) at the turn of the nineteenth century were perhaps the most fascinating ones, made by a technique called "papier-mâché" meaning chewed paper in French (Ortug & Yuzbasioglu, 2019). In 1842, the first Ottoman-Turkish veterinary school was formed, largely to develop and care for army horses (Ortug, Uluışık & Ortug, 2021).

In a medical curriculum, anatomy and surgery are the only visual or 3D subjects (Prentice, 2005), hence we can rightly term Anatomy as the mother of surgery and other medical sciences.

With the dawn of the 21st century and the rapid population boom of the planet, there has been a mushroom growth of medical schools and colleges all over the planet. This has materialized in the creation of a lot of new job opportunities for fresh graduates not only in clinical sciences but basic sciences too.

Sadly, Anatomy had never been a preferred choice as a career for fresh graduates, reasons for which we shall try to find out in this review and how the subject itself has been treated by clinicians, academia, and students over time. Still, the importance of this subject cannot be minimized despite many manipulations with the curriculum all over the world.

Anatomy as an area of medicine has infiltrated so many fields, and as a result, it is cardinal to consider while making a professional choice. We are continuously learning more about anatomy every day, despite the fact that it has been

practiced for thousands of years. Anatomists are continually discovering new structures whether microscopic or macroscopic particularly about humanly body structure (Stanford, Rutland, Sturrock & Rutland, 2020).

This paper will try to find out the shortcomings, and variations suffered by the subject and may be able to provide a clue why is such an important subject cannot be a career choice for fresh graduates. The paper seems the first from the Arab world to focus on this important topic as no previous literature showed that such work has been done before in the region.

2. MATERIAL & METHODS.

A review of the online available literature for a period of last more than two decades was done. Only the articles that were pertaining to the subject of anatomy were chosen. Topics selected were prioritized as per the anatomy as subject and career. An effort was made to collect the papers from varied contents and regions so the evidence gathered could hold a universal appeal.

3. DISCUSSION

Whilst it has been argued that many areas of basic science will change over the course of a doctor's professional life, precluding their inclusion in a 'core curriculum'; gross human anatomy will certainly remain constant. Anatomical knowledge backs the examination of a patient, the formation of a diagnosis, and the communication of these findings to the patient and other medical professionals. It provides a platform of knowledge common and suitable to all medical careers (Turney, 2007). Anatomy always has been a cornerstone of medical education for hundreds of years and it is proclaimed that it has survived the most demanding pedagogic test – *time*. However, in recent years, there have been efforts to slowly squeeze the human anatomy from the medical curriculum. Although this limitation of the subject is being argued, discussed, and planned the world over.

Digging rationally, anatomy is not a single subject but a fusion of subjects ranging from gross anatomy dividing further into general and special

categories, then there is the developmental, neurological, and microscopic study of form and structure and not to forget the latest addition to it; the clinical anatomy. In a 2019 study conducted in Abraka, Nigeria, to view anatomy as a career option, it was found that medical students do like anatomy as a course, but interest in anatomy as a career option was found to be low (Oladunni, Emmanuel, Jonathan & Okoh-Uku, 2019).

Anatomy has long been a foundational course in medical education, regardless of country or specialty. Its only pedagogy till recently was dissection and didactic lectures. To further consolidate and enrich the learning experience, the teaching style has been revolutionized with a greater focus on models, imagery, simulation, and the internet. The high cost of not focusing on adequate anatomy education would inevitably result in unskilled anatomists and healthcare workers, putting patients at risk (Sugand, Abrahams & Khurana, 2010).

In Australia and New Zealand where medical schools have decreased the Anatomy teaching hours dramatically in recent years, it was found that the curriculum content, instruction approach, and assessment differed greatly amongst institutions as there is no national curriculum for anatomy training. Such variation in anatomy education and assessment raises a crucial question: Do the graduates of different medical programs have or will have varying levels of mastery of anatomy? (Craig, Tait, Boers & McAndrew, 2010).

As elaborated, understanding human developmental anatomy is essential for accurately diagnosing and treating patients with congenital clinical entities. Therefore, the importance of developmental anatomy in the medical curriculum merits careful consideration. The Educational Affairs Committee of the American Association of Clinical Anatomists (AACCA) designed a clinical anatomy curriculum in developmental anatomy in order to provide help in establishing an undergraduate medical curriculum that adequately handles developmental anatomy, for the institutes that believe in promoting the subject as a specialty. It covers the topics and principles that will enable physicians to not only diagnose and treat congenital illnesses but also to provide a

firm foundation for future discoveries, particularly in the rapidly growing field of molecular developmental anatomy. It may also ensure that all medical students receive methodical training in developmental anatomy and that each student, regardless of the institution attended, is exposed to a curriculum that will provide him or her with the necessary competence and confidence to practice medicine effectively in the twenty-first century (AACCA, 2000).

There is widespread agreement that the number of contact hours of this fundamental discipline in a packed college curriculum is steadily decreasing. The same might be said for postgraduate specializations in which surgical anatomy is crucial. Patient safety is going to be harmed in the long run as a result of this lack of appropriate anatomical information. A content and extent reduction policy in most medical schools have had and continues to have, a significant impact on anatomy directly and hence the quality of the medical graduates produced, indirectly. A rise in medico-legal claims has also been linked to poor anatomy knowledge. Surgical anatomy courses at the postgraduate level and the restoration of dissection courses at both levels could all be steps in the right way to transform the current situation (Yamine, 2014).

According to some doctors, the least amount of anatomy is required for clinical practice. This saga creates interpretational difficulties for anatomical distortions or structural changes that affect organ and system functions. An interwoven inter-relationship among Anatomy, Physiology, Pathology, Radiology and clinical sciences is essential and required for accurate diagnosis and treatment analysis. This augments what has been reported in the literature that lacking understanding of anatomy often leads to very low clinical practice comprehension as Anatomy is 'most vital' for clinical practice (Singh, Yadav, Pandey &, Jones, 2022). To overcome this synopsis inclusion of a system-based approach to anatomy training in a medical school curriculum can spark a transformation (Reeves, Sheedlo & Roque, 2005).

At the outset of the twentieth century, medical education became more standardized and remained rather consistent until recently. It is

believed that incorporating a patient-centered or case-based curriculum will reinforce basic science principles. One disadvantage is that cadaveric dissection hours in the gross anatomy laboratory are reduced. Limited anatomical exposure leaves knowledge gaps in those entering the surgical profession, which shall be or has to be remedied during residency training (Heisler, 2011).

A paradox has been observed in anatomy teaching as the amount of content and knowledge about anatomy has grown, while the number of hours allotted for topic instruction has shrunk. This factor may and can stress the use of time-saving and effective educational tools. There is no single academic strategy or prototype in anatomy teaching that has been proven to be superior to another (Moro, Štromberga, Raikos & Stirling, 2017). However, four suggested strategies found in the literature could be:

1. Cadaveric dissection is a fantastic anatomy learning tool, but it necessitates a lot of resources, infrastructure, and time. Prosections and plastinated specimens, which are real human specimens, should be the second choice, followed by three-dimensional interactive dissection tables, which allow students to explore life-size anatomy, and other learning modalities (Ghosh, 2017).
2. Cutting-edge technology can be effectively used to study the subject's complicated principles and to enhance passive lectures.
3. Active learning approaches such as problem-based learning, computer-assisted learning, and case studies may be used in the classroom (Papa & Vaccarezza, 2013).
4. If cadaveric dissection resources are limited, anatomy and surgery postgraduate students or residents may be given priority in using these materials.

With the advent and advancement of a new technique termed '*Omics*' technology, the scope of the subject has now expanded to cover genetic illnesses (Bhattacharjee, Ceri, Holland, Holmes, Kilroy, McGonnell & Reynolds, 2021). This also helps to bury the stigma that anatomy is not a

science because it is not a research-driven discipline.

Similar problems have been found in Pakistan, where approximately a decade ago, anatomy was stressed as a core basic element within a typical medical science curriculum in all medical and dentistry universities. Now that schools are embracing problem-based learning (PBL) teaching philosophies, the techniques and extent of anatomy education shall be hotly debated since medical colleges in Pakistan has introduced a PBL curriculum that exposes the basic sciences largely in clinical contexts. PBL curriculum, it is believed, dilutes basic science teaching, particularly anatomy (Memon, 2009).

In a study, it was found that the dissection group had much higher post-course exam results. These findings got challenged when the course duration was changed. There is no compelling evidence that one method is preferable to the other when it comes to teaching surgical anatomy. According to learner surveys, dissection does improve the learning experience (Koh, Yeow, Srinivasa, Ng, Ponnampereuma & Chong, 2021). Many times successful surgeons are the ones who had been enthusiastic dissectors in their student years. With the use of newer techniques and methods, anatomy teaching can be turned into an interpretive process rather than a purely descriptive one. This can result in more efficient use of expertise, which is likely to be more enjoyable for both teacher and student. (Eizenberg, 2015, Eizenberg and Briggs & Barker, 2014).

There is a need to create a postgraduate Anatomical Sciences degree program in response to the expanding usage of online education resources and the growing demand for anatomical education from non-traditional student cohorts (Alethea, Kelsey, McCulloch, Gillingwater, Findlater, Jennifer & Paxton, 2020).

There is a lot of discussion about the best ways to communicate anatomical knowledge. For safe clinical treatments, competent clinicians, particularly surgeons, require a thorough understanding of anatomy. However, because students have had such minimal exposure to anatomy throughout clinical training, there is concern that medical students will be unprepared for clerkships and residency programs when they

enter them. As a result, creating efficient teaching techniques for anatomy is critical for safe medical practice. For hundreds of years, cadaver-based instruction has been the primary teaching instrument; nevertheless, opinions differ on whether full corpse dissection is still acceptable for current undergraduate education. Many medical schools have abandoned costly and time-consuming dissection-based instruction in favor of alternative methods of instruction such as prosection, medical imaging, living anatomy, and multimedia resources due to a lack of curricular time, trained anatomy faculty, and resources for gross anatomy courses in integrated or/and system-based curricula (Estai & Bunt, 2016). There is an urgent need of bringing morphological findings closer to practical medicine concerns, especially crucial during the reform of the healthcare system in any part of the world (Mel'man & Shutka, 1988).

A person who examines disease origins and effects, frequently using bodies to diagnose illness or determine the reason for death is for sure going to be a good clinical practitioner.

Evolution is a long-term process, and only those who are able to alter "survive." The COVID-19 pandemic has completely transformed modes of anatomy instruction. "Should dissection be included in the medical school curriculum or not?" proved to be a hot debate among the anatomy community, and the pandemic presented a forced opportunity to investigate the "cadaverless" anatomy education scenario around the world. During the crisis, anatomists did turn to the many virtual platforms available to investigate new technologies, teaching approaches, and evaluation methodologies as quickly as possible. Over the years, this subject has also evolved from a single subject to a combination of various subjects. Hence, every aspect has changed, from cadaver procurement, embalming, and preservation to curriculum, literature, teaching techniques, and examinations. A growing number of medical students, restricted resources allocated for the subject by the institutes, and less time given to the subject in the new curriculum have forced every anatomist to learn new procedures. Anatomy has been evolving since its inception but more rapidly over the last two decades (Singal, 2022).

During the COVID-19 lockdown, distance learning (DL) in many subjects has been granted and it has been found that connecting the DL-precepts framework with individual domains of the key learning outcomes framework, has proved beneficial for imparting the core knowledge (Naidoo, Azar, Khamis, Gholami, Lindsbro, Alsheikh-Ali & Banerjee, 2021).

A higher education paradox is the reduction of academic posts in higher education and the increase in graduate entrance rates. PHT (planned happenstance theory) is a professional development concept that emphasizes positive outcomes from uncontrollable pre-career experiences. PHT-based educational techniques emphasize that graduates with fresh metacognitive skills can pursue new job pathways (Bazos, Attardi, Baytor & Wilson, 2021).

It is important to remember that the potential for developing new instructional tools to give the greatest anatomy education is limitless given the current availability of animation tools and software that can simulate a virtual world. It's the right time to blend traditional anatomical instruction with innovation, which requires modern anatomists to work with both traditional and tech-savvy scientists. This will not only enhance the appeal of a subject but will generate more interest in today's *technophile* students. Anatomy is the only 3D subject that is taught in the preclinical years and we anatomists shall use this tech boom for our use and survival. In a very interesting study done on medical students in India in 2004 with a focus on anatomy as a subject and career, the majority of the respondents agreed that Anatomy was a basic pillar for being good physicians. However, the percentage of responses for taking up the subject as a career was moderate, the majority thought that they would take it up as a career if better research facilities are provided (Anand, Raibagkar & Ghediya, 2004).

The well-known saying of Tiedemann Heidelberg, 1781–1861, a pioneer German Anatomist and Physician of his period;

"Doctors without anatomy are like moles.

They work in the dark and the work of their hands are mounds."

It still seems applicable even after more than two and a half centuries (<https://www.ub.uni->

heidelberg.de/Englisch/helios/digi/anatomie/tiedemann.html).

4. CONCLUSION

The vertical integration of basic science and clinical practice requires an understanding of anatomy. Cadaveric dissection and evaluation of prosecuted specimens are two common pedagogies. Many educational breakthroughs are on the horizon that will have an impact on anatomy education in the future. Using interactive online multimedia as a comprehensive self-paced substitute for didactic lectures to assist students to prepare for practical classes is one example. Teaching and learning materials are inextricably linked. With the right application of the former, the latter can be transformed. Teachers will not be replaced by interactive multimedia, but they will be able to avoid getting drained (and thus burnt out) by addressing much of the theory that would otherwise result in a large lecture load. This would free up time for lectures that teach principles and practical classes (preferably dissections with clinical procedures) that include the active discovery of their implications and applications. The role of regulatory bodies/councils like national medical councils can be instrumental in promoting the Anatomy, e.g., as per the laws of the Pakistan Medical & Dental Council medical colleges have been provided with a minimum number of must-have faculty for 50, 100 and so on students, in an institute.

Although Medical education is worst if treated as a business is a bitter reality that there is a global growth of medical institutes in the recent past decade or so. The subject has never been a career choice but for a few. This trend was noted worldwide as monetary benefits are of paramount importance in today's mechanized world and, as they say, money makes the mare go. If regulated properly this can be good for the new lucrative jobs that can be created in this section of medicine which has long been neglected and despite its importance not given the deserved respect.

5. CONFLICT OF INTEREST

The author declares no conflict of interest whatsoever.

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