

## Modern teaching and learning of anatomy in Health Professions' undergraduate and postgraduate training curricula

Anastasios A.Vartholomaios

*MD, PhD Consultant Histopathologist, State Forensic Pathology Service, Thessaloniki*

### ABSTRACT

**Background:** Last years it is debatable whether cadaveric dissection is the more indicated method for the learning of gross anatomy, while there has been a vast increase in claims associated with the lack of anatomical knowledge. Modern medical imaging techniques and the wide availability of quite stunning digital images of the body have revolutionized teaching and learning and greatly facilitated this approach. Computer-assisted learning (CAL) is an effective supplement to conventional methods of teaching anatomy, since it provides the student with an important additional resource and facilitates alternative modes of learning. Also the plan to teach anatomy within a pathologic and clinical context and to relate form and structure with function in health and disease makes learning anatomy more attractive and has a greater appeal for the student. This plan for a new pathologically orientated and clinically applied, structuring of the content of the courses is especially supported by the above reformation of teaching methodology through new imaging and digital technology.

**Key words:** Anatomy, teaching, learning, digital, imaging, techniques.

### CORRESPONDING AUTHOR

*Dr. Anastasios A. Vartholomaios, MD, PhD*

*Consultant Histopathologist*

*17<sup>th</sup> Noemvri 16, A. Toumba*

*543 52 Thessaloniki, Greece*

*Tel: 2310 944949*

*E-mail: pathan@otenet.gr*

### INTRODUCTION

Anatomy has arguably the longest history as a discipline in formalised health sciences education. Human anatomy is not just the study of structure or morphology but the human anatomist is likened to a geographer of the human body. Regarded as an integral component of the medical

curriculum, a sound knowledge in human anatomy prepares the health sciences undergraduate for his future training in the clinical disciplines. Learning anatomy and understanding the structure of the body relates to its functions has been the foundation of medical education and practice for hundreds of years. Historically health professions students learnt anatomy by literally taking a body apart. In recent times this approach has been questioned and students may be expected to know their way around, the body using different strategies based on modern technology.<sup>1</sup> Health professionals must have "x-ray vision", that is when examining a patient or performing a clinical procedure must have in mind a three-dimensional image of what lies beneath the skin. In addition they should be aware of the range of normal variation both between individuals and within the same individual at different times of their life. Modern medical imaging techniques and the wide availability of quite stunning digital images of the body have

revolutionized teaching and learning and greatly facilitated this approach.<sup>2</sup>

Gross anatomy is considered the cornerstone in the health professions curriculum. Cadaveric dissection has been a regular feature in anatomy teaching since the Renaissance. In fact, dissection evolved into part of the culture in medical education. Last years it is debatable whether cadaveric dissection is necessary for the learning of gross anatomy.<sup>3</sup> Besides, it is acknowledged that there are barriers to the use of human cadavers for teaching. The practical problems associated with dissection are the increased length of time required for study of anatomy by dissection, the increased knowledge and taught modules load and the difficulties in acquisition of cadavers.<sup>4</sup> Even within the anatomist community, there are differing viewpoints as to whether the new methods of teaching anatomy are better than the traditional use of cadaveric dissection. In a survey of 112 professional anatomists it was found that the order of

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preference for teaching methods (in descending order) was cadaveric dissection by students, prosection, living and radiological anatomy, computer-aided learning (CAL), didactic lectures alone, and the use of models.<sup>5</sup>

Recent reports from Europe and rest world claim that the teaching and learning of anatomy in universities is in crisis. The evidence most frequently quoted for the so called crisis is the assertion that there has been a vast increase in claims associated with the lack of anatomical knowledge. This claim was based on the finding that "damage to underlying structures" was the commonest reason for claims related to general and vascular surgery and that lack of knowledge of anatomy is one important cause of such intraoperative errors.<sup>6</sup> This crisis is attributed to inadequate time being allocated to the subject and decreased opportunities to dissect cadavers. Also, although everyone would agree that anatomy is important, few object to the move away from endless hours of cadaver dissection. Besides,

quite a lot of arguments have been raised against use of cadavers, including cultural or educational principles as well as costs, hazards and practicality.<sup>7</sup> So, more efficient use of new technology and teaching methods in anatomy should allow a better teaching and understanding towards overcoming this crisis. Integration of newer teaching modalities and modern technology will encourage interest and retention of anatomical knowledge and its clinical relevance.

For health professionals, the human body is the focus of investigation and intervention on a daily basis; for this reason, the study of anatomy in some form will continue to be essential to safe medical practice. It is necessary for core knowledge of anatomy to be assimilated by all health professionals in order to practice and communicate safely. Balances between assimilation and application of anatomy, anyway, have yet to be established as the methods of teaching undergo another metamorphosis.<sup>8,9</sup> It may be true

that most health professionals do not need to dissect a cadaver or study a prosection in order to practice, but if it can improve their understanding of what they do and why they do it, this surely has to be of benefit both for the safety of the patient and satisfaction of them as professionals.

Designing courses that produce students with less understanding of human anatomy is not a viable option. Faced with the challenge of teaching more anatomy with less time, it is necessary to find how students should employ instructional media to learn anatomy inside and outside of the classroom and how they would combine instructional technology with more traditional classroom and laboratory-based learning. Knowing that students prefer interactive exercises that require problem solving and provide immediate feedback, academic teachers look at web-based computer exercises that have proved to be a popular mean to supplement and enhance traditional learning.<sup>10-12</sup> Computer-assisted learning (CAL)

is an effective supplement to conventional methods of teaching anatomy, since it provides the student with an important additional resource and facilitates alternative modes of learning that are well suited to the requirements of students in subjects allied to health professions.<sup>13,14</sup>

UK medical schools are transforming the way their students learn anatomy with the help of anatomy software programme.<sup>15,16</sup> It develops and enhances a range of learning objects that are used alongside text books and clinical practice in the teaching of anatomy. The beauty of these softwares is that they are based on real images not artists' impressions; it is also the fact that one can reconstruct, rotate and examine a 3D image on a 2D screen. This makes it easier for students to contextualise their learning more effectively than they would through text book images alone. They provide a comprehensive range of three-dimensional images, animations and detailed text for use in healthcare and patient education. They not only

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offer accurate clinical detail but also offer interactive images that rotate and display up to 24 layers for in-depth anatomical exploration.<sup>17-19</sup>

Modern health professions education demands a direct transfer of preclinical learning objectives and clinical practice. Universities have designed courses that, rather than presenting details for memorization, have transformed how a student thinks about anatomy and assimilates new knowledge, using common surgical and medical cases as the core of the revised anatomy course. It was found that this clinical approach focuses students' attention on the critical skills of spatial reasoning and the application of structure-function relationships, while freeing students from endless hours of memorization that produces little true learning.<sup>20</sup>

The plan to teach anatomy within a clinical context and to relate form and structure on function makes learning anatomy more attractive and has a greater appeal for the student. So, teaching anatomy and teaching clinical sciences and expertise

become more integrated, which is the most essential target in the undergraduate education of health professionals.<sup>21</sup>

Classroom activities in anatomy teaching might intend to teach students about articles in scientific periodicals as well as about scientific writing as a function of inquiry-based learning in anatomy. These activities aid students in understanding the use of diagrams and graphs to convey scientific information in science journals, the creation of abstracts for science articles and the composition of science articles regarding anatomy projects.<sup>22</sup>

Moreover, anatomy has a promising future also in postgraduate clinical training in health professions education. Detailed knowledge from specific fields of anatomy should be integrated into postgraduate training when they are clinically relevant, allowing health professionals to practice more safely and accurately and also to be provided by a strong base for future clinical developments.<sup>23</sup>

Concerning the structure of anatomy teaching material for health professionals, functional anatomy is the indicated framework, that is anatomy with a functional essence and application and not a simple morphology discipline.<sup>17,21</sup> There are 3 ways of organizing the study of functional anatomy :systemic, regional and clinical. Systemic anatomy is a sequential study of the functional systems of the body. It is usually how anatomy is tackled in integrated medical curricula. It often does make sense to group structures that work together to perform a particular function because they will share common physiological mechanisms and some have physiological effects across the entire body, as is the case with the nervous, endocrine and immune system. Regional anatomy recognizes that the body is organized into specific regions to ease understanding and takes into account the arrangement and relationships of adjacent organs from different systems. Knowledge of the regional organization is useful when

performing a physical examination and may be vital in treatment with utmost significance in surgical procedures. Clinical anatomy is the application of anatomy to the symptoms experienced by patients. Certain new textbooks have a generous percentage of the text related to clinical anatomy, but variations are substantial. Anatomic societies recommendations contain 20% of clinically-related terms, though this could be taken as an optimal proportion for the curriculum that is clinically oriented<sup>24</sup>. This plan for a new applied structuring of the content of the courses is especially supported by the above reformation of teaching methodology through new imaging and digital technology.<sup>18,22,24</sup>

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