

Should Gross Anatomy be taught systemically or regionally?

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SUMMARY

While the teaching of gross anatomy remains a topic of considerable discussion (and occasional controversy), in terms of the time allocated, timing within the course, content and clinical relevance, and the use of cadavers and dissection by students, there is relatively little discourse about whether gross anatomy should be taught systemically and/or regionally or whether anatomy should be integrated or a stand-alone course. This brief article analyses the differences between the systemic and region approaches, suggests ways in which the efficacy of these approaches might be investigated, and assesses how they might be integrated into other biomedical sciences and into clinical disciplines. Overall, we conclude that, even within health care studies courses such as medicine that are integrated, there should be a stand-alone component for the study of gross anatomy that takes a regional approach; although undoubtedly study of anatomy both systemically and regionally would be the ideal situation (time and resources permitting).

Key words: Gross Anatomy – Medical Education – Regional Anatomy – Systemic Anatomy

Recent curricular developments for health care studies programmes, and especially medicine, have led to marked changes in the teaching of gross anatomy (e.g. Dangerfield et al., 1996; Verhoeven et al., 2002; Drake et al., 2002, 2009; Pabst, 2009; Moxham et al., 2011). Indeed, it is often said that anatomy courses in particular are under pressure and the reasons for this are many and various but beyond our present remit. Given that there is the erroneous belief that anatomy is largely content-driven and not skills-based, it is frequently stated that anatomy needs to be diminished in importance since there is a need to reduce factual overload (e.g. General Medical Council's Tomorrow's Doctor's, 1993, 2009; Morley, 2003). The changes that have taken place in the teaching of gross anatomy have, however, not just involved decreasing the time available to teaching and learning the subject (e.g. Dangerfield et al., 2000; Plaisant *et al.*, 2004; Lockwood and Roberts, 2007; Drake et al., 2002, 2009), but have often required employment of new teaching methods (Utting and Willan, 1995; Dangerfield et al., 1996, 2000; Verhoeven et al., 2002; Ashwell and Halasz, 2004; Pabst, 2009; Moxham et al., 2011), sometimes without what is seen as the traditional use of

human cadavers (e.g. Sawday, 1995; Aziz et al., 2002; Gregory and Cole, 2002; McLachlan et al., 2004, McLachlan and Regan de Bere, 2004). There is already much in the literature debating these matters but, unfortunately, a consensus has yet to be established, not only because of ideological arguments between those who describe themselves as “modernists” or “traditionalists,” but also because there has been too little quantitative and rigorous investigation. A further complication relates to a division between anatomists about the approaches to be adopted and, in particular, whether a systems methodology or regional (topographical) methodology should be employed. The purpose of this brief article is to analyse the differences between these two methodologies, to suggest ways in which the efficacy of these approaches might be investigated, and to analyse how they might be integrated with the other biomedical sciences and the clinical disciplines.

It is first necessary to define terms. According to *Stedman's Medical Dictionary* (2006), a systemic approach to teaching and learning gross anatomy is defined as “anatomy of the systems of the body; an approach to anatomical study organised by organ systems emphasizing an overview of the systems throughout the body,” and this involves a whole body methodology that would describe all organs and tissues for a particular system, to the virtual exclusion of other systems, and without recourse to precise locational parameters and the understanding of relationships between differing organs or tissues. On the other hand, a regional/topographical approach would concentrate on locational parameters of organs and tissues. Thus, a systemic approach would provide the students with information under such heads as: musculoskeletal tissues, cardiovascular organs/structures, neuroanatomical components and various sub-systems under the category of splanchnology (e.g. digestive system, respiratory system, endocrine system and urogenital system). The regional approach would not just describe structures within the head and neck, thorax, abdomen and pelvis, back and limbs but would also subdivide these regions into, for example, the infratemporal fossa, the pleural cavity, the epigastric region, the cubital fossa, the anterior compartments of the lower limb, etc. At a shallow level of thought, these approaches seem to be totally divergent.

However, it could be argued that, in essence, the thorax locates the cardiovascular and respiratory systems, the abdomen and pelvis houses the digestive and urogenital systems, and the limbs and back constitute the musculoskeletal system. Accordingly, the regional approach takes on broad aspects of the systemic approach. It is axiomatic that both the systemic and regional approaches have sets of advantages and disadvantages that need to be understood before devising learning outcomes for a gross anatomy course in a healthcare studies programme and indeed before choosing appropriate teaching methodologies and assessment procedures.

The systemic approach for gross anatomy has the advantage of enabling the student to see the entirety of organs constituting major clinical systems pathologies, as well as providing a clear framework for the understanding of the biology underpinning the biomedical sciences. It is readily integrated with microscopic anatomy and functional anatomy, as well as fitting most comfortably with integrated medical curricula. Another advantage is that it provides the students at the beginning of their medically-related studies with the descriptive skills for different types of anatomical structures and thus providing useful “tools” for future clinical reasoning. One important disadvantage is that the systemic approach does not fit well enough with the requirements for those who are training to become surgeons or radiologists, nor does it allow for an understanding of how trauma or lesions at specific locations affect the related tissues at those specific locations. Thus, an explanation of how a patient's signs and symptoms present are not easily understood by a systemic approach alone. Furthermore, it is difficult for those who are taught gross anatomy only by a systemic approach to then be able to conjecture or apply their knowledge into an understanding of regional anatomy. The systemic approach is also not best suited for teaching that involves dissection (either by the students or from their observation of standard prosections, although the production of some specialised prosections could help in this matter).

For the regional approach to gross anatomy, it follows from what has already been said that the main advantages are to help in the training of surgeons and radiologists, to aid in the understanding of the presentations of

signs and symptoms (semiology) for lesions at specific locations, and in enabling the appreciation of anatomy through the medium of dissection. The greatest benefit, however, is in enabling students to appreciate structures 3-dimensionally and to organise structures as they are found from surface to deep levels, which is not available for the systemic approach. Its major disadvantage comes from a lack of fit with fully integrated medical programmes. However, despite this disadvantage it is eminently possible for students who have completed their studies of anatomy regionally to be able to translate this information into a more whole body, systemic understanding. Thus, for example, while a student who has been taught anatomy systemically should be able to describe the entire course and function of the vagus nerve, they would not have the knowledge of its precise locations along its course and they would find it difficult to ascertain the relationships of adjacent structures along its course. On the other hand, the student of regional anatomy who has dissected the head and neck, the thorax and the abdomen should be able to build up a picture of the entire course of the nerve in addition to having the locational and relationship knowledge already available from their topographical organisation of anatomical knowledge.

Given that the two approaches have been adopted to varying degrees at different universities worldwide, we are surprised that few investigations have been undertaken to compare the efficacies of the systemic versus the regional approach. It seems to us that there should in the first instance be an evaluation worldwide of the extent to which a systemic, a regional, or a mixed-mode approach is adopted at our universities and medical schools. It would then be possible to appraise attitudes of both academics and students at institutions using different methodologies towards the pedagogic approach that they have used or have been the recipients of. The third type of investigation would involve comparing students' anatomical knowledge, including the effectiveness of applying anatomical knowledge to clinical scenarios, and thus compare results from different universities using systemic and/or regional approaches. It is our fervent hope that time, money, and enthusiasm will be in sufficient supply to enable such investigations to be undertaken for it is important that such investigations do take

place in the near future given that so many curricular changes are taking place worldwide for sometimes spurious, or ideological, reasons.

These matters have significance in relation to the development of integrated courses for healthcare studies programmes. The assumption is often that integrated courses are more modern and, by implication, superior to traditional, subject-based courses, because they are thought to produce more holistic, clinically relevant outcomes. This is despite the fact that models of medicine are presently shifting from the disease-based model implicit in the integrated approach that emphasises clinical pathologies to a model that centres health and how medical conditions can be ameliorated to ensure optimal functionality (e.g. Wade, 2009). This change highlights the fact that medicine should be more about health than disease. The emphasis on disease, often prevalent in integrated medical courses, can have unfortunate consequences by changing the culture of medicine away from the health/functionality model. Furthermore, Hattie (2009) has reported that integrated approaches in education are not as effective as is often supposed. In considering two meta-analyses involving 61 studies and nearly 8,000 students, he showed that integrated programmes did not produce the desired educational effects but were more reliant on teacher effects (the abilities and enthusiasms of the teachers themselves). It might be construed from this that imposing a methodology on teachers unsympathetic to the approach may have a more deleterious effect than educationalists usually surmise. From studies conducted to assess the attitudes, course aims, and teaching methods for the teaching of gross anatomy in the medical curriculum (Patel and Moxham, 2006, 2008; Moxham and Moxham, 2007; Moxham and Plaisant, 2007), it was reported that both professional anatomists and students, while very supportive of the clinical importance of anatomy and of the many skills that can be derived from anatomy, surprisingly did not rate highly the importance of anatomy in providing foundation material for other biomedical sciences. The authors concluded that, perhaps even in an integrated course, gross anatomy needs to be taught by means of a standalone course at an early stage and before more integrated approaches are employed. This conclusion has recently been supported

by the research of Kerby, Shukur and Shalhoub (2011) and by Regan de Bere and Mattick (2010). Regan de Bere and Mattick (2010), building upon their earlier findings (Mattick and Knight (2007), concluded that “anatomical practice as it is applied to medicine, requires multiple layers of capability that extend beyond learning anatomy as a subject in itself,” and that “anatomy distinguishes doctors from other scientists and, while requiring clinically-relevant teaching, is best not subsumed into other disciplines”.

Where integration has been introduced into a medical curriculum, problem-based learning (PBL), or methodologies belonging to that family (case-based learning or enquiry-based learning), have frequently been employed. Anecdotally, it is said by many that PBL approaches undermine gross anatomy by requiring little study of the subject, thus influencing students to take a superficial or strategic learning approach to the subject. This view is supported by the work of Nayak et al. (2006), who reported that many aspects of anatomy were not covered adequately through PBL problems. The use of PBL in medical education is increasingly being criticised and courses that have extensively used PBL are sometimes returning to mixed mode or non-PBL methodologies (e.g. Harvard medical school). Criticisms of PBL as they relate to anatomy (reviewed by Pabst, 2009) highlight the inadequacy of the approach. For example, the achievements of medical learners on PBL and non-PBL courses do not differ (e.g. Verhoeven et al., 1998) and, in particular, Prince et al. (2003) showed that there was no significant difference in anatomical knowledge. Furthermore, PBL learners themselves perceived that they were deficient in anatomical knowledge. In more general terms, Hattie (2009) assessed 8 meta-analyses of the educational effects of PBL that involved over 285 studies and just over 38,000 students. He reported that PBL did not have positive and desired educational effects, any effects being attributed to teacher effects or developmental effects. Furthermore, no educational-desired effects were seen from enquiry-based teaching or from co-operative learning, and very little positive effects were found even from small group teaching. Thus, if integrated approaches and the use of the PBL family of methodologies are not so efficacious

as is so often believed then there appears to be little justification in decreasing the teaching of biomedical sciences, including gross anatomy (and indeed the regional approach), that is perceived as being so important for the understanding of health and disease. This perception, expected of professional anatomists, is shared by the students (Moxham and Moxham, 2007; Moxham and Plaisant, 2007), and by many in the clinical specialties (and not just surgery and radiology). Returning to the question of whether gross anatomy should be taught systemically or regionally, we would argue strongly that the evidence favours the view that gross anatomy should, at the very least, constitute an introductory foundation course to any healthcare studies programme and should require minimally a regional approach. However, if time and resources allow, most benefit would of course be derived from both a regional and a systemic approach.

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