Eur J Anat, 9 (2): 111-115 (2005)

Reflections and challenges in the teaching of human anatomy at the beginning of the 21st century

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SUMMARY

The last years of the twentieth century and the first years of the third millennium have been a critical time in the teaching of Gross Anatomy. In the present work the authors report and analyse the reasons why Gross Anatomy lost importance as a major subject in medical teaching in the last century, basing their arguments on the data found in the literature. Among these causes, we analyse the following: the stagnation affecting the teaching of Gross Anatomy; the decline in anatomical dissection; the delayed introduction of other teaching methods; the formulation of aims and contents; the amalgam of professionals from different fields forming Departments of Anatomy, and the identity crisis experienced by anatomists. We also address the efforts of professionals to bring about changes in the teaching of anatomy through (among others) the use of new technologies; application of technological advances in the field of medical education; increased time spent on dissection; the compilation of a common medical terminology, and the development of greater "dynamism" in Anatomical Societies and Federations. Finally, the authors offer some general considerations aimed at defending and improving the teaching of Anatomy in medical curricula and the dissemination of Anatomy and anatomical research, and give a brief outline of their own experience at the University of Salamanca (Spain).

Key words: Gross anatomy – Conceptual instructions – Medical education – Anatomy teaching – Human cadavers

INTRODUCTION

It is generally accepted that over the past few years the teaching of Anatomy across the world has been losing importance as one of the basic pillars in medical education, although currently we are witnessing a resurgence in the teaching of Anatomy. Perhaps the first step in this decline in the interest in Anatomy occurred in 1957 when the General Medical Council lifted the mandate that *"All medical students should perform the dissection of a complete human body"* and since then dissection began to be questioned (Newell, 1995). In 1984, Kénési used the following words in a title to an Editorial of the journal *Clinical Anatomy*: *"The place of Anatomy in the medical curriculum in France: A noble past, a calamitous present, a precarious future"*, the latter part being recalled by Yates - the then President of the American Society of Anatomists- in another Editorial (1999) of Anatomical Record (The New Anatomist). More recently, Reidenberg and Laitman (2002), also in *The New Anatomist*, began their article with *"The old Anatomy is dead. Long live the new Anatomy"*. The advent of medical curricular reform in many medical schools meant that there was less time for anatomical instruction, with problems in some Universities for teaching the subject in a dignified way. Since this was the case of Spain and since one of the authors in Secretary General of the Spanish Society of Anatomy, we are evidently interested in the issue and decided to review the most important causes that have led the teaching of Anatomy to be debated and to offer some ideas for the futu-

Submitted: May 26, 2005
Accepted: August 12, 2005

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re. The references used are very extensive and we only list those of the greatest relevance to our objective.

A further goal of this paper is to analyse some of the actions that Anatomy Departments and Societies are implementing to adapt to current changes. Finally, we offer some general considerations aimed at calling attention to the issue and at encouraging a joint effort by all to ensure that Anatomy will have the place it deserves in the different medical curricula, among them those offered at the University of Salamanca.

The teaching of Anatomy is being questioned

It has been considered that *Anatomy is an exhausted science*, with no future in investigation and rooted in the past (Kénési, 1984); that *dissection, a technique specific to Anatomy, is increasingly less popular, and* that the contents taught in Anatomy are not well defined. In this sense, Wise (2000) states that in many Anatomy Departments there is an amalgam of disciplines of Anatomy and cell and molecular biology and that it would be necessary to integrate all of these in teaching if a better understanding of the human body is to be gained. Jones (2000) also confirmed that consensus must be reached concerning the contents of Anatomy; indeed, in many medical schools to speak of Anatomy is to speak of gross Anatomy, matters such as Embryology or Neuroanatomy being excluded from the term (Wise, 2000).

Also, the *teaching methodology and the goals of learning Anatomy are discrepant,* and in many Departments teaching is based only on lectures and many hours of dissection, with excessive contents that prevent students from discerning between what is essential and what is accessory in clinical practice (Reidenberg and Laitman, 2002). Further, *the professional situation of Anatomy instructors has been devalued* and the curricular requirements of promotion, and sometimes the training background of Anatomy teachers in medicine (non-medical teachers), means that more importance is given to research than to teaching. Accordingly, the applied part of Anatomy is disappearing (Jones, 2000).

As a result of these factors -and perhaps due to a certain stagnation among anatomists (Daley II, 1997) changes have been introduced into the curricula of the various Schools of Medicine; changes that have lead to a *decrease in the number of hours devoted to Gross Anatomy in medical curricula* (Yates, 1999; Leong, 1999; Cahill et al., 2000; Aziz et al., 2002) and *its replacement by other disciplines that are gaining ground daily.*

Actions being implemented for the teaching of Anatomy to adapt to current changes

Despite the foregoing, questionnaires given to students and medical staff highlight the importance of Gross Anatomy as essential study material in medical degrees (Pabst and Rothkotter, 1996; Cottam, 1999) and the decrease in instruction in Anatomy is currently causing severe problems for medical professionals when they identifying structures, analysing images, using surgical approach routes and the possible consequences of these, etc. In this sense, in the United States, about one third of resident physicians are insufficiently prepared in Anatomy (Cottam, 1999), which means that some medical errors are due to the poor training of the medical staff (Gawande, 1999), in which a lack of anatomical knowledge should be included (Cahill et al., 2000).

The teaching of Anatomy is currently under close scrutiny. There are many opinions in the world literature about how Anatomy should be taught and which issues should be addressed in the teaching of Anatomy in medical curricula; Gross Anatomy, Clinical Anatomy, Embryology, Neuroanatomy are considered to be essential (Moxham, 1999; Yates, 1999; Skandalakis, 2000). Moreover, there seems to be a general trend towards broadening the teaching of Anatomy to life-long learning and the postgraduate scenario; to specialists, and to the training of Anatomy instructors. All this would involve an in-depth knowledge of advanced and specific Anatomy (Kénési, 1984).

The methods used in the instruction of Anatomy are being reappraised. The use of new technology. While there are some Universities in which Anatomy instruction is independent of other subjects, in others integrated methods are used in the horizontal or vertical sense, with the participation of more disciplines, including clinical issues. Despite this, the results seem to vary to some extent (Vidic and Weitlauf, 2002).

As an anatomical technique, dissection has been questioned by some authors, although most seem to be in favour of it (Mc Garvey et al., 2001; Johnson, 2002).

To palliate the reduction in hours devoted to dissection, at many Anatomy Departments there have been proposals to use prosections or peer teaching as learning methods for students (Sholley, 1994; Aziz et al., 2002; Johnson, 2002); dissection at times when it is of greatest interest (Shaffer, 2004), or the inclusion of other instruction systems, such as multimedia programs through computer-assisted teaching (Moore, 1998; Drake, 1998). This latter is considered a clear, renewable, rapid and efficient way of offering 3-D images (Cahill et al., 2000), or introducing new technologies, such as the readily expandable and understandable streaming media.

Among many others, Lippert (1982) and Skandalakis (2000) are in favour of instruction in Anatomy oriented towards clinical practice. In many Departments, much importance is given to Living Anatomy, Functional Anatomy, and Imaging Anatomy, the teaching being correspondingly oriented in these directions or at least as an important complement to the teaching of Anatomy as a whole (Cahill, 1997; Satyapal and Henneberg, 1997; Grechening et al., 1999; Tavares et al., 2002; Boon et al., 2002).

In recent years, Clinical teaching has been taught through Problem-Based Learning methodology, accompanied by anatomical texts with that particular orientation. In some Universities, it covers all the subjects of the curriculum (Albanese and Mitchell, 1993) while in others one or more courses of this type are included in the conventional curriculum (Boon et al., 2002; Chakravarty et al., 2005, among many others).

Other Universities include action-research methodology applied to the clinical teaching of Gross Anatomy (Tavares et al., 2002), experimental models with animals such as the pig (Hubbell et al., 2002), the body-paint method for teaching Living Anatomy (op den Akker et al., 2002), or instruction courses based on teamwork (team-based learning) (Nieder et al., 2005).

Adaptation of Departments to the new demands and consensus as regards goals. After an analysis of the structure and composition of Anatomy Departments by different authors (Doran, 1994; Jones and Harris, 1998; Cahill et al., 2000), most seem to be of the opinion that the composition of the teaching staff should be more heterogeneous.

According to Skandalakis (2000), Anatomy instructors should preferably be trained physicians so that a clinical orientation can be given to the subject, although at the same time interdepartmental collaboration should be fostered with the aims of integrating teaching, developing life-long training courses at post-graduate level, and intervening in the training of clinical specialists. Some even believe that Anatomy should be recognised as a medical speciality (Satyapal and Henneberg, 1997).

A dynamic outlook in Societies and Federations. Applied use of Anatomy has led to the constitution of Clinical Anatomy Societies in the USA, France, Great Britain and Ireland, China, Japan and Russia, and with them the publication of journals such as "Clinical Anatomy", "Surgical and Radiologic Anatomy", which includes abstracts from the Chinese Journal of Clinical Anatomy and The New Anatomist as a section of the journal "The Anatomical Record".

These Societies have created a renewed and more dynamic outlook for Anatomy. Multilateral meetings between anatomists from all over the world are being fostered and the publication of a new edition of Anatomical Terminology has been promoted. Programs aimed at improving the clinical teaching of Anatomy have also been proposed[1].

General considerations and experience at the University of Salamanca

It is clear that to diagnose alterations to organs or body systems the physician must have knowledge about and know how to recognise any part of the human body; further, anatomical savvy is today fundamental for interpreting a large number of imaging techniques: hence the relevance and basic importance of having both theoretical and practical knowledge of Human Anatomy.

We would like to have the term "*Human Anatomy*" well specified and common for all; it should include Gross and Microscopic Anatomy, Embryology and Neuroanatomy, since study of the morphology of the human body is the object of all of these disciplines.

The Human Anatomy to be described to students should be both descriptive and applicable in clinical medicine. All the different methodologies discussed above are good and all have some advantages and drawbacks. We therefore believe that the best option is to apply several of them, depending largely on the infrastructure available in the different Departments. Accordingly, we harbour a wish that there be better and broader communications among the Anatomical Departments with a view to improving as much as possible the teaching of Anatomy; this is indeed quite feasible through different Web sites, the creation of a common website, taking advantage of the proposal of the European Federation of Experimental Morphology (EFEM) concerning the Trans-European Pedagogic Research Group, where the teaching of Anatomy can be debated. We also believe in encouraging the committees of the International Federation of Associations of Anatomists (IFFA), mainly those of the Anatomical Formation and Anatomical Publications, and defending and promoting the declaration made by that Federation in Kioto (2004) concerning progress in the morphological and anatomical sciences in the pursuit of the health and well-being of humankind.

We also believe that the teaching of Anatomy should not overlook cadaver dissection since *if Anatomy is a science this is due to the practice*

[1] The Federative Committee on Anatomical Terminology (1998) and Societies such as the American Association of Clinical Anatomists, through the Educational Affairs Committee, have compiled programs in clinical Anatomy (1996) and Embryology (2000); they have established guidelines to be followed concerning anatomical knowledge in certain invasive procedures (1999) and the wy to use clinical Anatomy via physical medical examination (inspection, palpation, percussion, auscultation). Likewise, the Dutch Society has compiled programs on Gross Anatomy (1999) and Embryology (2000).

of dissection. In this sense, we feel that opinions of Aziz et al. (2002) and of Johnson (2002) are very relevant: the need to use this technique and propitiate educational debates such as that held in 2004 in Anatomical Record (The New Anatomist) about *"to what extent is cadaver dissection necessary to learn medical Gross Anatomy"* (Guttmann et al., 2004), open to all anatomists through on-line information about virtual dissection and medical education (www.wiley.com.anatomy/dissection). In the teaching of Anatomy, the Nomina Anatomica should be used, in the vernacular (Satyapal and Hennberg, 1997), so that there will be uniformity when employing anatomical terminology. Nevertheless, as stated by Haines et al. (2002) it is true that some of the terms widely used by clinicians should not be forgotten; instead their use should be encouraged.

Another of our beliefs is that instructors in Anatomy should carry out appropriate tutorial work in their teaching activities, counselling students about what elements of, and how, they should acquire their anatomical knowledge. The dissection theatre is an ideal place for such counselling and this activity is in fact a further step in the new process of European convergence.

It is desirable to establish training of excellence in Anatomy instructors, be they physicians or not, and to accomplish this we consider it crucial for there to be life-long teaching of the subject. In this sense, attention should be given to offers of specialist post-graduate courses, meetings or Congresses organised by Anatomical Societies, which should provide contents aimed at professionals devoted to Anatomy, and also on-line teaching by videoconferences or Web sites, which may be of great help in life-long training (Rizzolo et al., 2002; McNulty et al., 2004).

Naturally, research in Anatomy must be continued at our Departments. It is necessary to carry our basic research, if possible of an applicable nature, that will contribute to helping potential patients, in specific areas, and that can be divulged to the scientific community. To accomplish this we must ensure that journals of morphology or Anatomy gain better prestige, fostering the creation of electronic journals and even re-unifying some of those already in existence and developing opinion fora, as stated above regarding teaching through websites oriented towards topics of research in the field of morphology.

According to Jones et al. (2002), investigating what is taught is indeed possible at our Departments thanks to morphological techniques, which are broad and diverse: some, such as dissection, are very old, but still valid; others, such as plastination or the different applications of imaging techniques, have expanded the field of research to a considerable extent. And to this can be added the availability of on-line IT resources, such as the *Visible Human* project, *as* an important source of investigation into the human body. There are also extraordinarily modern and advanced techniques, such as molecular biology, or *in vivo* NMR, which allow researchers to engage in forefront investigation (Moxham, 2004). Naturally, team work –which may be multidisciplinary– is always the rule.

Unity and communications among Anatomical Societies and Departments and a more dynamic element in scientific publications are essential (Satyapal and Henneberg, 1997; Yates, 1999).

Concerning the above deliberations, the criterion followed at the University of Salamanca concerning the teaching of Anatomy is to combine dissection with the use of interactive methods. Accordingly, we bolster the use of traditional lectures with tutored work, mainly in the dissection theatre; there, students perform partial dissections that are complemented with prosections and peer teaching about other regions; this is necessarily so owing to the small number of cadavers available. Our students must return a final work project on the work they have carried out.

The interactive part is delivered through three different methodologies: compilation at the Department of a set of learning books (Vázquez et al., 2002) that the students must complete; consulting the literature, making drawings, looking for answers, applying their anatomical knowledge to solve clinical cases or describing anatomical sections, and the results of NMR, CT or other types of imaging techniques.

A second element involves group work, in which the students make posters, oriented towards the clinical teaching of Anatomy, which are later discussed by them in front of their peers.

Finally, there is monitoring -always accompanied by cadaver dissection- of the students' study of the human body by reconstructions by means of dissection planes (Smith Agreda, 2000). This is a fairly interactive methodology that ensures a good learning of topographic Anatomy on the part of the students.

As conclusions, we believe that we should be very clear about what should be studied in Anatomy; we should tend towards a teaching of Anatomy that is as applicable as possible, explained by well trained professionals, and we should make the new methodologies compatible with the other more traditional ones, providing students with data that are relevant for their future professional activities. It is necessary to use the new technologies to communicate with and help our students, always seeking union among all anatomists, the Departments themselves and the different Anatomical Societies participating in this to do so.

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