

The Current Status of the Anatomical Sciences Curriculum in U.S. and Canadian Dental Schools

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Abstract: The anatomical sciences form one of the major building blocks of the basic medical sciences in the professional training of dentists. This paper defines the courses and classifies the formats of teaching for each course within the anatomical sciences curriculum. Information was gathered from the Internet, specifically the American Dental Education Association (ADEA) website links to U.S. and Canadian dental schools and their online catalogues or bulletins as well as online course syllabi. The results demonstrate the distribution of schools in the United States and Canada teaching anatomical sciences in the following categories: stand-alone, sequential, and multifaceted courses for gross anatomy; stand-alone and integrated courses for histology; stand-alone, integrated, incorporated, and no course for neuroanatomy; and stand-alone, incorporated, and no course in embryology. This paper concludes with the proposition that a survey of the usage of anatomical knowledge in use in a typical dental general practice needs to be conducted. The results of such a survey need to be evaluated with the intention of determining what should be taught in a dental clinical anatomical sciences curriculum.

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The anatomical sciences form one of the major building blocks of the basic medical sciences in the professional training of dentists. At this juncture, medical and dental school curricula and, more specifically, the anatomical sciences program are undergoing a major review at many institutions. To comprehend the evolution of the anatomical sciences curriculum into the twenty-first century, we must first define the anatomical sciences curriculum for dental schools and then determine how it is taught in North America.¹ Next, we determine how much of the anatomical sciences are taught in the dental school curriculum. Lastly, we must consider if what is taught in the anatomical sciences curriculum is truly relevant to the clinical practice of a dentist, or if the anatomy faculty are teaching towards an exam, i.e., National Board Dental Examination, Part I. The latter topic will not be covered in detail, but initial steps are proposed for the development of a survey to evaluate the daily usage of anatomical knowledge.

The anatomical sciences curriculum in the majority of medical and dental schools consists of the following courses or topic areas: Gross Anatomy, Histology or Microanatomy, Neuroanatomy, and Embryology. However, the anatomical sciences are

also commonly taught to varying degree in the following dental courses that exist in most schools: Oral Biology, Oral Development-Craniofacial Embryology or -Craniofacial Development, Developmental Biology, Growth and Development, and Craniofacial Biology.

The major question for developing the anatomical sciences component of the curriculum is: What is the goal of the anatomical sciences curriculum? Traditionally, the goal of a basic biomedical sciences curriculum is to prepare students for subsequent components of clinical training.² Within anatomy, the goal is to give students a theoretical and geographic orientation to the human body and its tissues, as well as to help students understand developmental processes. Of course, an additional pragmatic goal is to prepare students to pass the anatomical sciences portion of the National Board Dental Examination, Part I.³

In general, there are three approaches to teaching the basic sciences portion of the dental and medical school curriculum. The first approach is the traditional discipline-based strategy, where there is a course for each individual subject area such as anatomy, neuroanatomy, histology, pathology, physiology, pharmacology, or microbiology. The second approach is commonly called the integrated block

system, which is basically a systems-oriented approach. In an integrated block system, students study the cardiovascular, respiratory, neurological, gastrointestinal, genitourinary (reproductive and renal), and musculoskeletal systems. The third approach is known as problem-based learning (PBL) or case-based learning. In this method, a problem is presented, and the students gather information about it.^{4,5} It is not necessary to solve the problem, but the experience of gathering and learning the information to support an understanding of the problem is where the learning occurs.^{4,5}

The gross anatomy curriculum could be classified as being singular or stand-alone, a sequence of courses, or a multifaceted course. The singular or stand-alone course is completely devoted to gross anatomy. Furthermore, the stand-alone course is taught on a regional or systemic basis. The sequence refers to a series of gross anatomy courses, one of which usually covers the head and neck, one covers a specialist topic for the dental student, and one covers the rest of the body. The multifaceted course contains not only gross anatomy but also neuroanatomy or embryology.

The curriculum for histology or microanatomy can be classified as either a stand-alone course or an integrated course covering basic and systemic histology as well as oral histology in detail or embryology. The stand-alone histology course covers the basic organization of cells and tissues and a study of the various systemic tissues. The integrated course includes the stand-alone course and a detailed study of oral histology and/or embryology.

Neuroanatomy courses are classified as stand-alone, integrated, or incorporated. An integrated neuroanatomy course is essentially a neuroscience course, where the individual components—neuroanatomy, neurophysiology, and neuropharmacology—are brought together to reflect the total integration for understanding the nervous system.⁶ In an incorporated course, neuroanatomy is included within the gross anatomy course or the more specific head and neck anatomy module.

Embryology, which is sometimes known as developmental biology, is classified either as stand-alone or incorporated. In an incorporated course, embryology is included within the gross anatomy course. However, embryology is often included with histology and other dental basic science courses, such as dental anatomy.

Methods

There are currently fifty-five dental schools in the United States and ten in Canada. Data was obtained for fifty-two schools in the United States and ten schools in Canada. We were unable to obtain data for three schools, which were Meharry, the University of Puerto Rico, and the School of Dentistry and Oral Health, Arizona School of Health Sciences, which is affiliated with the Kirksville College of Osteopathic Medicine. The source for the information was the ADEA Links to Dental Schools website and each schools' published catalogue or departmental program outline as of March 2002.⁷

Results

The approach to the teaching of anatomical sciences in the dental curriculum was very traditional. Forty-six schools in the United States and seven in Canada used the traditional discipline-based approach for teaching anatomical sciences. Four schools in the United States used the integrated block method or systemic approach. The PBL or case-based approach was used in three schools in the United States and three schools in Canada. One dental school, the University of Southern California, has both a PBL and traditional curriculum.

Regarding the anatomical sciences curriculum, twenty-two schools in the United States and one school in Canada teach gross anatomy as a singular or stand-alone course. All but one school in the United States teaches gross anatomy via a regional approach in the stand-alone course. The sequential method of teaching gross anatomy, in which gross anatomy is broken into separate courses of head and neck anatomy and other regional anatomy, is taught at eleven schools in the United States and three in Canada. Within the sequential method, four schools in the United States and two schools in Canada included neuroanatomy within the head and neck anatomy course. Lastly, the multifaceted gross anatomy course was taught at thirteen schools in the United States and three schools in Canada: of these, neuroanatomy was included at eight schools in the United States and two schools in Canada, and embryology was included at five schools in the United States and one school in Canada. These numbers are

summarized in Table 1. An interesting observation was the variance in what regions of the body were covered. Most gross anatomy courses cover the head and neck, thorax, abdomen, upper limb, pelvis and perineum, and lower limb, but the biggest variation in the depth of coverage occurs for the upper limb. Numerous courses did not cover lower limb or pelvis and perineum.

The curriculum for the histology course is classified into stand-alone or integrated as seen in Table 2. Thirty-two schools in the United States and four in Canada teach a stand-alone histology course. The integrated approach to histology occurred at fourteen schools in the United States and three schools in Canada. Within the United States, one school integrated histology with physiology, while eight integrated neuroanatomy with histology and five integrated embryology with histology. In Canada, two schools integrated neuroanatomy and one integrated embryology with histology.

The teaching approach of the neuroanatomy curriculum varies considerably as neuroanatomy can be integrated as part of a neurosciences course or problem-based session or it can be incorporated into gross anatomy, histology, or head and neck anatomy. Thirty-three schools in the United States and one school in Canada had a stand-alone course for neuroanatomy. Twelve schools in the United States and four schools in Canada incorporated neuroanatomy with the gross anatomy. Four of these schools in the United States and two in Canada integrated neuroanatomy with a head and neck anatomy course specifically. Three schools in the United States integrated neuroanatomy into a neurosciences course. No neuroanatomy was taught at three schools in the United States and one school in Canada. This data is summarized in Table 3.

The classification of approaches to teaching embryology is stand-alone, incorporated, or none as

Table 1. Number of schools using a curriculum format for teaching gross anatomy (non-PBL curriculum)

Curriculum Format	Number of Schools in United States	Number of Schools in Canada
<i>Singular or Stand-Alone</i>	22	1
Regional approach	21	1
Systemic approach	1	0
<i>Sequence</i>	11	2
Includes Neuroanatomy	4	3
<i>Multifaceted</i>	13	3
Includes Neuroanatomy	8	2
Includes Embryology	5	1

Table 2. Number of schools using a curriculum format for teaching histology (non-PBL curriculum)

Curriculum Format	Number of Schools in United States	Number of Schools in Canada
<i>Stand-Alone</i>	32	4
<i>Integrated</i>	14	3
Includes Neuroanatomy	8	2
Includes Embryology	5	1
Includes Oral Biology	1	0

Table 3. Number of schools using a curriculum format for teaching neuroanatomy

Curriculum Format	Number of Schools in United States	Number of Schools in Canada
<i>Stand-Alone</i>	33	1
<i>Integrated</i>	3	0
<i>Incorporated</i>	12	4
Into Gross Anatomy	8	2
Into Head and Neck Anatomy	4	2
<i>None</i>	3	1

The numbers do not total similarly to the totals in other tables as neuroanatomy may be specified differently in the PBL curriculum.

Table 4. Number of schools using a curriculum format for teaching embryology (non-PBL curriculum)

Curriculum Format	Number of Schools in United States	Number of Schools in Canada
Stand-Alone	10	0
Incorporated	21	1
Incorporated with Gross Anatomy	5	1
Incorporated with Histology	10	0
Incorporated with Oral Biology	6	0
None	4	0

The numbers do not total similarly to the totals in other tables as there is not enough information available about embryology.

detailed in Table 4. The embryology course was incorporated into gross anatomy at five schools in the United States and one in Canada. Within the United States, ten schools incorporated embryology with histology, six schools included embryology with oral biology, and ten schools had a stand-alone course for embryology. There were four schools in the United States that did not have embryology in their curriculum at all.

Discussion

The key questions are: Is there a best approach to teaching the anatomical sciences? If not, how can we determine the best approach? We must determine what is relevant in the anatomical sciences curricu-

lum by revisiting the goals of the dental school basic sciences curriculum and surveying practitioners about the usage of anatomical knowledge in daily practice. The next step is to look at the students and analyze their learning strategies. Such a survey would be conducted at dental schools in North America to obtain an overall view of the typical dental student's learning style.⁸ Finally, we must reflect on this question: Are we overteaching the anatomical sciences curriculum within the dental school curriculum?

To this end, Dr. Marcel D'Eon at the University of Saskatchewan College of Medicine and I designed a survey to evaluate the use of anatomical knowledge in the daily routine of general practice and specialist dentists (see Figure 1). The survey, which we plan to implement in 2003, will be sent to a randomly selected sample of general dental practi-

Terms	Number of years in practice	Frequency										Trend in Frequency			Clinical Importance		
		The frequency of patient encounters where knowing about this concept was relevant.										The frequency of patient encounters where knowing about this concept was relevant is...			How important is knowing about this concept for how I manage patient problems I encounter in my practice?		
		I have no idea what this means	a few times per year	once or twice a day	several times a day	decreasing greatly	decreasing	stable	increasing slightly	increasing greatly	Not important at all	Somewhat important	Important	Very important			
Example: right ventricular infarction				X								X					
inferior alveolar nerve	0-12																
mental nerve	0-12																
lingual nerve	0-12																
mandibular nerve	0-12																
muscles of mastication	0-12																
superior constrictor muscle	0-12																
pterygomandibular raphe	0-12																
maxillary nerve	0-12																
facial nerve	0-12																
buccinator	0-12																
glossopharyngeal nerve	0-12																
parotid gland	0-12																
parotid duct	0-12																
ramus of the mandible	0-12																
condyle of the mandible	0-12																
tragus	0-12																
palatoglossus muscle	0-12																
hyoid bone	0-12																

Figure 1. Survey about the relevance of anatomical terms in dental practice

Table 5. List of terms for survey of dental practitioners

Inferior alveolar nerve	Buccinator
Mental nerve	Glossopharyngeal nerve
Lingual nerve	Parotid gland
Mandibular nerve	Parotid duct
Muscles of mastication	Ramus of the mandible
Superior constrictor muscle	Condyle of the mandible
Pterygomandibular raphe	Tragus
Maxillary nerve	Palatoglossus muscle
Facial nerve	Hyoid bone
Buccal nerve	Infraorbital nerves
Inferior oblique muscle (the eye)	Medial rectus muscle (the eye)
Maxillary sinus	Vomer
Pylorus of the stomach	Duodenum
Left ventricle	Right pulmonary artery
Anterior interventricular artery	Bicipital aponeurosis
Median nerve	

tioners and dental specialists in North America. Respondents will be asked to indicate the frequency of patient encounters where knowing about various anatomical concepts is relevant, whether their use of the anatomical knowledge is decreasing, stable, or increasing in their practice, and the clinical importance of knowing the concept or term. The anatomical terms are listed in Table 5.

Currently, many basic science courses teach to the requirements of the National Board Dental Examination (NBDE), Part I. However, rather than relying exclusively on board content to dictate course topics and depth of instruction, teachers may need to be more cognizant of what is required of the students for practice and their lifelong learning. In this respect, to what extent do the dental boards reflect what is expected for the knowledge and practice of dentistry? It is hoped that a more appropriate clinical anatomical sciences curriculum can be effectively developed for the dental school curriculum of the twenty-first century by surveying general dental practitioners as well as dental specialists about their anatomical knowledge.

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