

Appendix V

REPORT
on
1st Year BASIC SCIENCE
TEACHING

Prepared for
DISCIPLINE HEADS MEETING
FACULTY OF DENTISTRY
UNIVERSITY OF TORONTO

24th November 2003

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Executive Summary:

The original mandate of this report was to assess forthcoming needs of the Faculty of Dentistry in the teaching of Anatomy, Embryology, Histology and Oral Anatomy within the perspective of several key faculty retirements. However, a revised mandate was created to first allow an assessment of the opinions of faculty and students regarding the current strengths and weaknesses of basic science teaching in the first year of the DDS course and also to construct, with the benefit of this input, a vision for the future of such teaching within the Faculty of Dentistry, University of Toronto. The goal therefore became to establish a new vision for basic science teaching which would, in turn, provide a framework to define our needs for teaching in both the individual subject areas originally targeted and those other basic science subjects covered, or initiated, within the first year DDS curriculum.

What emerged is an exciting new vision of what basic science teaching in the U of T could become. This is of particular importance in light of the radical changes that have occurred in medicine over recent years, which has seen major emphasis on molecular medicine in diagnosis and therapy. Thus, an early introduction to cell and molecular genetics could provide a central construction theme to link a new approach to basic science teaching with clinical practice. This theme would not only provide the foundation for the classical disciplines of embryology, histology, and craniofacial anatomy, but also underpin the understanding of the development of the dentition and occlusion, dental variation in form and function, wound healing, and oral pathologies. Such an approach would have many advantages, among which would be the easier introduction of the concepts of molecular approaches to dental therapy, exemplified by growth factor therapeutics, to the use of stem cells in tissue regeneration.

Within this new context, some subject-matter such as introductory non-craniofacial anatomy could be taught through extant courses offered to other health care professionals, while other courses could be supplemented by custom computer-based learning modules to economize on scheduling time which would have to be found to cover the new material. Importantly, the remaining current basic science 1st year courses should be merged within a single course framework with the intention of providing a more coherent and logical coverage of the subject matter.

Together with this renewed emphasis of the importance of the scientific foundation of modern dentistry, the 1st year students should be rapidly challenged and motivated by exposure to complex clinical cases which represent the pinnacle of current dental practice. By a new juxtaposition of fundamental basic science and glimpses of advanced clinical problems which are addressed by modern dentistry, from the outset, students will approach the basic sciences as an integral part of modern dental practice rather than an academic hurdle to be overcome and promptly forgotten.

Importantly, such a radical shift in emphasis within the teaching of basic sciences would not only more efficiently bring the available basic science faculty expertise into the U of T DDS program, but would also ensure that the latter becomes an international flagship of dental education.

It is recommended that a small working group be authorized to formulate a draft teaching program that would meet the objectives outlined above.

**Format for Oral Presentation at Discipline Heads
Meeting November 24th, 2003.**

- PowerPoint presentation summarizing this report (appended).
- Demonstration of computer animations of peri-implant bone healing.
- General discussion – Q & A.

Preamble:

At the request of Dean Mock, a study was initiated to explore the teaching of Anatomy, Embryology, Histology and Oral Anatomy in the first year DDS curriculum. Thus the original mandate was to assess forthcoming needs of the Faculty of Dentistry in the teaching of these subjects in view of the retirement, or imminent retirement, of several key faculty members who are currently responsible for their teaching.

It became clear at the outset, that to assess our needs as a Faculty of Dentistry it was first necessary to explore the rationale for the current approach for teaching the individual subjects, and how this could fit into a plan for the future development of the basic science components of the DDS degree. To make such an assessment without some notion of the future role that basic sciences should play in the DDS curriculum would be at best myopic and at worst entirely redundant.

Thus, a revised mandate was created, by the author, to both assess the opinions of Faculty and students regarding the current strengths and weaknesses of basic science teaching in the first year of the DDS course and also to construct, with the benefit of this input, a vision for the future of such teaching within the Faculty of Dentistry, University of Toronto. The goal therefore became to establish a new vision for basic science teaching which would, in turn, provide a framework to define our needs for teaching in both the individual subject areas originally targeted and those other basic science subjects covered, or initiated, within the first year DDS curriculum.

Preliminary Assessment:

There is no doubt that we have, at the University of Toronto, many excellent, and some outstanding teachers in the basic sciences. However, with the exception of Anatomy and Embryology, which are taught by the same person, Histology (including general and dental histology) and Oral Anatomy are taught as rather isolated courses, with little planned cross-over either between themselves or the clinical disciplines that they underpin. This is not to say that individuals teaching these courses do not themselves illustrate the clinical relevance of the subject-matter to the students, but rather that there is little communication between these basic science courses and the clinical courses within the DDS curriculum. Furthermore, an additional course, “Biological Basis of Oral

Health and Disease” has, despite repeated efforts by the course director to create synergy with the other basic science courses, also developed in isolation from them.

These disconnects within our teaching of the basic sciences are not only felt by those teaching the courses, but also by both other faculty and the student body. Therefore, to address our needs in dealing with the retirements of several key faculty who currently teach the basic science curriculum, it was first necessary to assess the need for such teaching within a wider context of DDS curriculum development.

Approach:

To gain some understanding of the broader issues involved, and engage both the faculty and students of the Faculty of Dentistry, a series of semi-formal interviews was conducted to discuss the teaching of the basic sciences, and the perceived need for such subject-matter, within the context of an evolving DDS program. Fourteen faculty, both full- and part-time, and a group of six students gave their time to be interviewed over a seven month period in 2003, together with numerous other informal discussions, to provide the feedback and stimulate the ideas which are represented in this report. Many were involved in more than one formal or informal interview session. In addition, some basic science lectures were attended to gain an understanding, at first hand, of how the students are currently taught. Furthermore, some exploration of more recent forms of teaching, including problem-based studies, web-based instruction and self-assessment modules and computer-based educational aids was also conducted. As a specific example of the latter, funding was secured to support the development of CD-based computer animations of wound healing phenomena relevant to the authors’ own research and teaching as an example of a new technology which could be harnessed in the development of new undergraduate teaching modules.

The various interviews referred to above were prefaced by reviewing the academic and clinical background of each respondent and, if appropriate their teaching experiences and responsibilities. The topics covered in these interlocutions ranged from current perceptions of the quality and quantity of basic science teaching within the faculty, perceived problems with the current teaching format(s) and the need for

individual courses, to the position of the University of Toronto Faculty of Dentistry in its' North American peer group and the perceived benefit of receiving a DDS from Toronto.

The fixed questions forming the backbone of each free-ranging interview were the following:

- What is the relevance of Anatomy/Histology to clinical dentistry?
- Do we need Gross Anatomy in the dental course?
- Should we combine our teaching with Medicine?
- Do we need General Histology
- Should Dental Anatomy etc. be combined with "Oral Biology"?

The purpose of each interview was not only to monitor the opinions of the respondent on the status quo, but also to solicit constructive suggestions of how basic science teaching could be improved.

Outcome of Interviews

It is clear that faculty and students share an overwhelming sense that U of T commands a leading international reputation in the basic sciences, but it was also generally felt that the expertise that this reputation rests upon is not adequately harnessed within the DDS program. Concern was expressed over the lack of synergy between the basic sciences courses currently taught in the 1st year and, especially from the student perspective, the redundancy in certain subject matter (students quoted 6 or 7 lectures on TB within the same year!). Furthermore, there seemed to be little concern that while the clinical teaching of dentistry has changed significantly within the faculty over the last decade – caries and periodontal disease are now taught as diseases to be treated from a medical perspective rather than pathologies to be surgically excised – the current basic science teaching structure provides an inadequate foundation for this changed approach. We need to be training Dental Physicians, not Dental Surgeons! This is of particular importance in light of the radical changes that have occurred in medicine over recent years which has seen major emphasis on molecular medicine in diagnosis and therapy.

What also emerged is an exciting new vision of what basic science teaching in the U of T could become. Based on an early introduction to cell and molecular genetics, this theme could underpin the construction of a new approach to basic science teaching which

would not only provide the foundation for the classical disciplines of embryology, histology, and cranio-facial anatomy, but also underpin the understanding of the development of the dentition and occlusion, dental variation in form and function, wound healing, and oral pathologies. This envisioned approach would have many advantages, among which would be the easier introduction of the concepts of molecular approaches to dental therapy, exemplified by growth factor therapeutics, to the use of stem cells in tissue regeneration. Importantly, such a radical shift in emphasis within the teaching of basic sciences would not only more efficiently bring the available basic science faculty expertise into the U of T DDS program, but would also ensure that the latter becomes an international flagship of dental education.

What follows is a summary of the most important facts, issues and ideas that have emerged from this wide-ranging exercise.

Current Perceptions:

- There is general consensus that the basic sciences are essential to the DDS curriculum, although the perceived importance of the basic sciences varies widely.
- With an increasingly educated public – primarily as a result of ease of access to information through the internet – it is incumbent upon the faculty to train new members of the dental profession such that they are well positioned to communicate with an educated public. *“Facts are public, experience means professional training”*.
- Generally, the current quality of DDS basic science teaching in Toronto was considered to be high and in some cases outstanding.
- Although there is a need to restructure the basic science teaching within the DDS course, some courses (Anatomy was that consistently cited in this context) are so good that they should not be changed. Unfortunately, as with all courses, the quality is a product of the dedication, enthusiasm, experience and knowledge of the course director. Gross anatomists are becoming rare with few young people taking this up as a career and few openings for those that do. While we have an

outstanding resource currently, we have to anticipate a different structure to the anatomy teaching following an imminent retirement.

- The Dental Faculty in Toronto is widely known to be strong in basic sciences, although the degree to which this international reputation impacts on the DDS course is unclear.
- Our faculty is widely regarded by those within it and our students alike, as one of the leading dental faculties in North America.
- It is widely held that, some essential basic training aside, a DDS from one school in North America is not necessarily the same as a DDS from another. For example, a common example quoted is that students at UWO receive more practical clinical training in their DDS than their contemporaries in Toronto. This is seen as a disadvantage for Toronto graduates – both by some of the students themselves and even one of our Faculty who teaches basic sciences!
- On the contrary, when asked, the majority of faculty and students see the basic sciences in Toronto as a major strength, which distinguishes us from other schools.
- Both faculty, and students in our faculty, are aware of serious disconnects both within the basic science courses and between basic sciences and the clinical teaching of the DDS course.

Major Recommendations

1. That the 1st year basic science curriculum be restructured to minimize the impact of impending retirements of key faculty while maximizing the opportunity to realign the curriculum to reflect a new vision for the role of the basic sciences in underpinning a DDS program designed to train Dental Physicians.
2. To achieve this goal, and being cognizant of the shifts in emphasis in both medical training and dental clinical practice, this restructuring should provide an opportunity to revitalize the teaching of basic sciences in dentistry in order to provide a more dynamic support for developing dental clinical practice.
3. The basic science course should be founded on an initial introduction to the molecular genetics of cell behaviour which will then provide a starting point to

- explain protein secretion, mapping, tissue structure and thus both embryology and histology. The outcome of these developmental themes will introduce tissue healing, anatomy, tissue regeneration as well as the need for tissue replacement materials (dental biomaterials). An outline of the initial weeks of such a course structure is provided below.
4. While gross systemic anatomy can be treated independently, the remaining basic science courses should be harmonized by combination. This would allow for easier relationships to be established between subject matter which is currently taught in isolation in different courses.
 5. A small working group of young faculty who would be primarily responsible for designing such a course structure and the majority of the teaching, should be identified and brought together with the mandate to take the findings and recommendations of this report and weld them into a new basic science course structure.
 6. Implementation of the new course structure could be staged, with current course amalgamation preceding the moving the larger teaching blocks such as Anatomy.

Outline of Proposed New Structure

The table below provides an idea of how the teaching of basic sciences could be restructured to meet the suggested vision. The courses written in bold approximate to the current course of the same name (where “Biological Basis of Oral Health and Disease” is truncated to Oral Biology). The emphasis, however, is quite different than that currently followed since the year would start with an introduction to Molecular Genetics which would lead to protein synthesis and matrix secretion that results in mapping of tissue development (embryology) and tissue formation (histology). Only after these subjects have provided the foundation would head and neck anatomy be started, as structural anatomy is the outcome of tissue and organ development. Systemic anatomy would be treated separately – possibly through utilizing an existent general anatomy course available elsewhere in the university. The Clinical Motivation would include exposure to highly complex dental treatments (by observation only, through visits to operating theatres, clinical rounds, PowerPoint lecture presentations – possibly with walk-in patients) in many fields which could include, as examples: management of advanced

calculus and associated gingivitis/advanced periodontitis; management of severe malocclusions by orthodontic and/or surgical treatment; treatment of children with avulsed teeth; restoration of the dentition through multiple single root implants; reconstruction of facial bones following an RTA; difficulties in establishing a comprehensive epidemiology survey of a dental care issue. These examples would be chosen to excite the 1st year students by the sheer complexity and variety of dental care so that they are motivated to learn the basics with a view to what is in store for them later.

Overview of Initial Weeks of 1st Year Basic Sciences				
Systemic Anatomy	Embryology	Introductory Course in Molecular Genetics Gene Expression Genetic Variation Protein Synthesis Mapping Secretion Tissue Generation Genetic Basis of Health and Disease	Cell Structure and Function	Clinical Motivation
	Craniofacial Embryology		Tissue Histology	Tissue Regeneration Biomaterials
	Head & Neck Anatomy		Oral Biology	

Further Recommendations

7. It is important to emphasize that adequate change will not be brought about by micro-managing individual courses. Indeed, it is clear that recent attempts by individual course directors, who may be relatively junior faculty, to create more efficient and logical course structures have failed due to overwhelming resistance from more senior colleagues who have rigorously maintained the status quo. Thus, it is important that the junior faculty, who represent the future educational foundation of the Faculty of Dentistry, be given an unequivocal mandate to design and institute a new basic science curriculum.
8. The timing of clinical training procedures and underlying basic knowledge should be carefully monitored. For example the students mentioned that they currently

- undertake scaling in November, but only cover medical history taking the following May.
9. Several suggestions were made with respect to the use of TAs or demonstrators for various courses. This is a practice widely accepted elsewhere in the University, but practiced little in the Dental Faculty. One area where this should be occurring is the demonstration of anatomy by surgical residents, but it seems that, due to scheduling difficulties, this rarely occurs.
 10. Much concern was expressed about examinations, in several different contexts: Canadian students are guided by the need to meet the requirements of US exams; Our level of examination in the basic sciences should be higher than those being set for related courses (e.g. hygienists); oral examinations (viva voce) should be re-introduced wherever possible. While this is staff-intensive, it tests the student on pertinent information under the stress of direct personal contact – a situation which is very relevant to the practice of dentistry; thresholds should be raised to raise educational level. We must be cognizant of the deliberations of both the National Dental Examining Board and the Commission on Dental Accreditation of Canada.
 11. We should encourage web-based and other electronic forms of instruction. These can provide detailed supportive course material, but should not replace direct, conventional, teaching methods.
 12. Basic sciences should be reviewed in 4th Year.

Acknowledgment

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