COMMENTARY

Horizontal Integration of the Basic Sciences in the Chiropractic Curriculum

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Basic science curricula at most chiropractic colleges consist of courses (eg, general anatomy, physiology, biochemistry, etc) that are taught as stand-alone content domains. The lack of integration between basic science disciplines causes difficulties for students who need to understand how the parts function together as an integrated whole and apply this understanding to solving clinical problems. More horizontally integrated basic science curricula could be achieved by several means: integrated Part I National Board of Chiropractic Examiners questions, a broader education for future professors, an increased emphasis on integration within the current model, linked courses, and an integrated, thematic basic science curriculum. Horizontally integrating basic science curricula would require significant efforts from administrators, curriculum committees, and instructional faculty. Once in place this curriculum would promote more clinically relevant learning, improved learning outcomes, and superior vertical integration. (J Chiropr Educ 2010;24(2):194–197)

Key Indexing Terms: Curriculum; Educational Models; Professional Education; Teaching

INTRODUCTION

Basic science curricula at most chiropractic colleges present students with general anatomy, neuroanatomy, physiology, biochemistry, and microbiology as independent disciplines. Professors from each basic science specialty typically emphasize discipline-specific content within their respective silos of expertise. While these courses have stand-alone value, chiropractic students also need to learn how the parts function together as an integrated whole. Health care education research has focused largely on vertical integration,[1–3] which attempts to create linkages connecting courses in different curricular divisions, for example, between basic science courses and clinical science courses. In contrast, horizontal integration attempts to create linkages connecting courses within a curricular division, for example, between anatomy and physiology courses. The purpose of this article is to demonstrate how horizontal integration within basic science discipline courses promotes clinically relevant learning, improved learning outcomes, and superior vertical integration.

NEED FOR INTEGRATION

Basic science courses are typically taught as stand-alone, independent content domains, which give students a view of the parts, but not the whole, of the structure–function relationship. Presenting material separately implies that the elements studied in each course are independent of one another. An integrated approach would show interdependence between the parts, for example, that physiology can be partially explained through anatomical structures, that biochemistry is related to physiology, and so on. The various structures and functions are not independent; they are interdependent, interacting cybernetically through multiply redundant positive and negative feedback loops. The human body is a dynamic system in which the whole is more than the sum of the parts.

The compartmentalization of the basic sciences poses additional problems for students as they enter

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into clinical coursework. Students struggle to apply a variety of discipline-specific knowledge fragments to a particular health problem. Thus, the lack of integration between basic science disciplines burdens both students and faculty at the clinical level. The current separate discipline basic science curriculum model emphasizes details at the expense of conceptual understanding, which hinders the progress of students who should be gaining appreciation for a chiropractic perspective as an integrated synthesis of all basic science disciplines.

IDEAS FOR HORIZONTAL INTEGRATION

Integrating basic science coursework in chiropractic college curricula is a formidable challenge that would require a fundamental shift in the current basic science educational paradigm and would require significant efforts from administrators, curriculum committees, and instructional faculty. The challenge of integration should not dissuade educators from making the effort. A variety of steps can be taken that would help students integrate the parts into a whole. Steps toward a solution include integrated Part I National Board of Chiropractic Examiners questions, a broader education for future professors, an increased emphasis on integration within the current model, linked courses, and, most radical of all, an integrated, thematic basic science curriculum.

Like the basic science curriculum, Part I of the National Board examination is organized around basic science discipline silos, thus discouraging interdisciplinary integration. Integrated National Board questions would encourage integration in students' education and thinking. An example of such a question is as follows:

ATP hydrolysis is typically most inefficient in the ___________

A. Masseter
B. Triceps brachii
C. Soleus
D. Myocardium

This question requires the student to define "ATP hydrolysis" (biochemistry), realize that it is most inefficient during anaerobic metabolism (physiology), and identify the muscle that is most often involved in anaerobic activity, triceps brachii (anatomy).[4] An individual chiropractic college's National Board pass rate is important to both administrators and prospective students. Consequently, such questions would likely cause educators to promote integration. More important, questions involving multiple subjects would require students to use their basic science knowledge in a practical manner. Indeed, real life processes in the body cannot be fully addressed by disciplines working in isolation from one another.

Curricular integration within chiropractic schools should begin with a change in the education of the educators themselves. If the faculty does not know how the basic science puzzle fits together, students will have little hope of assembling the pieces. Current graduate students in basic sciences, those who will be professors in the future, should take a more diverse selection of graduate level courses. This is not to say they should not specialize. Indeed, specialization has increased the quality of research in the field. A broader base of courses would encourage future professors to become well-versed individuals who value disciplines other than their own and have a sense of how their areas of study complement one another.

Professors could further promote integration by regularly presenting information from multiple areas of basic science within their respective courses. While courses would still be predominantly domain specific, the limits of each discipline would be admitted honestly. Moreover, instructors would regularly reference complementary research from fields outside their own. A major advantage of this approach is that it would not require radical changes to the current model. A recent example of cross-disciplinary integration combined neuroscience courses (neuroanatomy, neurodevelopment, neurophysiology, neurochemistry, neuroimaging, neuropathology, and neurogenetics) within an established chiropractic curriculum. A study assessing the program revealed increases in students' confidence, positive attitude, ability to learn, and perception of neuroscience content and knowledge. The authors also suggested that the program may enhance students' neuroscience knowledge and their ability to interpret clinical data.[5]

More proactive approaches to integration would include changes in how the course content is presented. One such change would involve linked courses. For example, anatomy and physiology could be taught as a single course. This would be logical because of the obvious relationship between structure and function. Linked courses would require two professors from different areas to meet and work out the content of each course collaboratively. Thus, linked courses would promote integration among the students and faculty. Moreover, information provided to the students in linked courses would likely be more congruent because it would be generated by two experts rather than one.

Different types of linked courses are currently utilized in chiropractic colleges. A course entitled "Structure: Spine" links "gross anatomy, embryology, histology, mycology, syndesmology, and osteology."[6] Similarly, "Organ System Microscopic Anatomy and Physiology I" links the anatomy and physiology of organ systems and describes how these systems interact.[7] When compared with conventional preclinical medical courses, linked courses yielded higher student competencies.[8] According to students, these courses were also more exciting[9] and more clinically applicable.[10]

The most radical solution to the integration problem would be to implement a cross-disciplinary approach, in which the basic science curriculum would be organized around thematic topics rather than independent discipline silos. Instead of courses in general anatomy or biochemistry, students would enroll in "Excitability and Synaptic Transmission" or "Principles of Sensorimotor Integration." In each thematic course students would learn applicable basic science knowledge ranging from anatomy to biochemistry, from the level of gross structures to that of chemical reactions. Literature on learning outcomes in a thematic basic science curriculum is scarce. Once in place this curriculum might promote deeper understanding, superior retention, and more clinically relevant knowledge. These expectations seem reasonable because the focus of the course would be on actual body processes, not merely the memorization of abstract discipline-specific information.

Some health care education curricula have used case studies both vertically and horizontally in a problem-based learning model. For example, a dental school problem-based curriculum attempted to achieve both horizontal and vertical integration in clinical sciences through clinical case scenarios completed by small groups throughout the curriculum.[11] This program was specific to clinical science and claimed that it successfully accomplished both vertical and horizontal integration without measuring performance. In the absence of outcome measures, it is questionable whether conclusions of success are justifiable or whether the conclusions can be applied to basic science courses. When compared with conventional curricula, vertical integration has been shown to improve student attitudes toward basic science,[12,13] stimulate profound rather than superficial learning,[14] and achieve equivalent competency with less instruction time.[15] While vertical integration may be beneficial in its own right, it does not address the problems of horizontal integration at the basic science level. Indeed, horizontal integration is necessary to take full advantage of vertical integration.[14]

The suggested integration strategies are useful only in so far as they actually help students to better integrate what they have learned. Interviews and follow-up studies should be conducted to determine the need for and the effectiveness of any strategies. Like many new ideas, the prospect of integration in the basic science curriculum is likely to be met with concern and skepticism, if not overt resistance. For more conservative educators, an integration seminar course can be effectively implemented[16] and would be a good first step.

CONCLUSION

Chiropractic's holistic paradigm[17] provides a perspective from which chiropractors can solve complex clinical problems by integrating the parts into a whole. The basic science curricula at many chiropractic colleges could be defined as reductionistic[18] in that they neglect the dynamic interaction between all elements, which describes how the system functions as a whole. Consequently, students may struggle to bring the big picture into focus. Comprehensive answers to questions about the how human body functions cannot be attained from independent, discipline-specific perspectives alone. Rather, human body function questions are better understood from an interconnected basic science perspective. A more relevant basic science education could be achieved by developing a more horizontally integrated curriculum in the basic sciences, which would then fit vertically into clinical science and internship education. Students, educators, and patients would all benefit from a more integrated basic science curriculum in chiropractic education.

CONFLICT OF INTEREST

The author has no conflict of interest to declare.

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