The Decline of Embryology Instruction Within Medical Schools Worldwide: Options for Adapting

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Abstract

There has been a drastic decline in the hours devoted to embryology within medical curricula worldwide over the past century. The instructional hours have dwindled to an annual average of seven hours within Canadian medical schools and 14 hours within the United States. Current evidence suggests that incorporating three-dimensional animations and models into embryology teaching may improve learner outcomes. Incorporating new teaching methods may ensure that medical graduates meet the embryological competencies needed to practice medicine safely, in spite of restricted instructional time.

Embryology is a fundamental component of a thorough medical education. Understanding the embryonic origins of human anatomy is essential for many fields of medicine, most notably those that deal with congenital abnormalities, such as pediatrics and obstetrics. Aside from clinical relevance, an understanding of embryology can improve and enrich students' understanding of human anatomy. Furthermore, an understanding of embryology can improve physicians' understanding of disease processes and the necessary treatment.[1] The significance of embryology is not lost on students. In a recent survey polling 146 British medical students, 81% stated that embryology should be included in the medical curriculum.[2] A similar survey within Australia found that an overwhelming number of medical school graduates believed that understanding embryology helped during their clinical experiences.[3]

Despite being recognized as an important facet of medical education, progressively less time is being allocated to anatomical sciences within the medical curriculum.[4,5] In 1909, over 900 hours of laboratory and lecture time was devoted to the anatomical sciences in American medical schools, compared to an average of 129 hours in 2016-2017.[4,5] This reduction in anatomy instruction has been attributed to several factors, including a shift to an integrated curriculum, an increase in curricular content due to advances in molecular medicine, and the need for future doctors to be educated in social determinants of health.[4]

Embryology instruction has declined as the anatomical sciences have been squeezed out of the medical curriculum. In 2016-2017, American medical schools allocated an average of 14 hours (SD ± 8) to embryology, with some schools allocating zero hours.[5] The limited teaching hours combined with the complexity of the subject has made learning embryology frustrating for students. Reports have shown that medical students are not confident in their embryology knowledge, find it difficult to learn, and consider it to be poorly taught during their undergraduate degree.[2,3] Overall, the evidence suggests that traditional teaching methods are not suitable for teaching embryology given the current time constraints.

Worldwide, the cutback in embryology is concerning enough that several expert groups have released syllabi for foundational embryological knowledge.[6,7] Here in Canada, a study from McMaster University showed that Canadian medical schools devoted an average of seven hours to embryology in 2016-2017, with the University of British Columbia reporting six hours.[8] The impact, if any, of severely limited hours of embryology instruction in Canadian medical schools and worldwide is worthy of rigorous inquiry. Are students confident in their embryological knowledge? Are they satisfied that the knowledge of embryology acquired in medical school will translate into competent clinical practice, not only for embryology–related disciplines, but also more broadly? These questions require urgent, systematic elucidation, at least within a Canadian context.

There is also the related question of how to best teach embryology effectively and efficiently, given the current time constraints. Currently, most studies focus on innovative methods used to teach gross anatomy. Given the close relationship between embryology and gross anatomy, it is reasonable to assume that many of the research findings in anatomy education would be applicable to embryology as well. By reviewing the current research surrounding anatomy education (and the few studies specific to embryology), educators can determine which best–evidence approaches may improve embryology teaching.

Online modules, videos, and interactive web atlases have been previously used to supplement the anatomy curriculum in medical schools, with students accessing the resources on their own time to reinforce concepts taught during lectures.[9,10,11] Studies have had mixed results as to whether or not online modules improve learning outcomes compared to lectures.[9,11,12] However, they have found that students' learning experiences are positively affected.[9,11,12] Interactive, three–dimensional images and animations are often incorporated into these modules as a way for students to participate in their own learning. Traditionally, teachers have used two–dimensional chalkboard drawings to illustrate static and dynamic concepts within anatomy. However, research shows three–dimensional images are superior to two–dimensional ones, as they increase learner satisfaction, factual knowledge, and spatial knowledge.[12,13] In particular, three–dimensional animations have been shown to improve understanding of dynamic processes such as embryonic development.[14]

It is important to note that while three–dimensional animations are a beneficial supplement to physical models and cadavers, they are not a suitable replacement. Evidence suggests that learning outcomes for anatomy, including spatial knowledge and long–term retention, are always better when a physical model is available to students.[15,16] Several studies have explored the incorporation of physical models, such as clary or three–dimensional printed models, in embryology teaching.[17,18,19] The evidence indicates that physical models are superior to three–dimensional images when it comes to learning embryology. However, physical models are not always feasible or accessible in the embryology classroom. Most embryology teaching no longer occurs in a lab, but in a lecture hall, where models must be passed around or assembled during limited instructional time.[4,5] It appears from the available evidence that, given the time constraints on embryology education, the consensus best practice would be employing online modules that incorporate three–dimensional images as embryology teaching adjuncts.

Going forward, hours devoted to embryology are unlikely to increase within the medical curriculum. Educators should adapt to the limited instructional time by using innovative teaching methods to ensure that

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students are meeting the necessary embryological competencies to safely practice medicine. The limited hours for embryology education may not impact students' embryological knowledge if instructors are willing to adapt. However, remaining bound to traditional teaching styles in today's environment will be to the detriment of learners and potentially patients.

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