As a result of this training need, the vertical integration of surveymonkey.com A survey was developed for a study population consisting of education. implemented across pre-clinical, clinical, and graduate medical curricula and a needs assessment was developed for the Yale Radiology Residency Program does not include embryology as a distinct, formal component of the curriculum.

Congenital malformations are frequently encountered in radiology practice. Residents must learn to recognize and accurately classify potentially complex three dimensional anatomic abnormalities across multiple organ systems, yet, radiology residents typically do not have formal anatomy or embryology training between the 2nd year of medical school and the beginning of radiology training (PGY2). Yale’s Radiology Residency Program does not include embryology as a distinct, formal component of the curriculum.

It was hypothesized that radiology trainees would welcome and benefit from an efficient, practical re-introduction of basic embryology and maldevelopment on which to build further understanding regarding the clinical manifestations, diagnosis and treatment implications of congenital malformations. A literature review was performed on current embryology curricula and a needs assessment was developed for the Yale residents to confirm our assumptions about the paucity of, and need for, training curricula. Once confirmed, a model, incorporating three-dimensional teaching modules could be implemented across pre-clinical, clinical, and graduate medical education.

A survey was developed for a study population consisting of Yale radiology residents and fellows – implemented via surveymonkey.com. Of the 39 respondents:

- 97% (38) viewed the topics of clinical embryology and maldevelopment as important to their specialty.
- 80% perceived their knowledge in this subject to be inadequate for clinical practice, but nearly 50% perceived their knowledge as adequate for in-service and board exams.
- 95% were interested in a dedicated learning module which included 3D animation and 80% indicated a preference for clinically oriented educational modules employing three-dimensional embryonic animation over a standard textbook format.

As a result of this training need, the vertical integration of training modules from pre-clinical to graduate medical education is considered.

### Introduction/Background

Potential scheme for implementing learning modules in preclinical, clinical and graduate medical education:

- **Preclinical:** A general module could supplement preclinical coursework in the anatomy and Master courses
- **Clinical and Graduate Medical education:** organ/ system based modules are catered to supplement learning objectives on clinical rotations and during residency training. Specialties requiring familiarity with congenital disease across multiple organ systems such as OB/GYN, Pediatrics and Radiology could benefit from a general module, and the subspecialties may focus on relevant systems based modules.

The figures above are movie screen captures illustrating development of the pharyngeal pouches from: Kyle E. Raray, PhD and Lynn J. Rowell, PhD, Clinical Human Embryology, Integrated Medical Curriculum, an example of a clinical, web-based Embryology education module utilizing volume rendered/3D animations.

### Needs Assessment

Future work will require additional needs assessment - including a survey of students, trainees and faculty of the medical school and graduate medical programs as well as potential coordination with developers of the new embryology curriculum.

### Projected Curriculum Requirements:

- Establish clinically oriented goals and objectives for each module
  - General Module
  - Specialty Specific Modules based on organ system
- Build / animate models vs Utilization of preexisting resource
- Interactive learning- investigate potential for 3D Virtual Learning Environment (VLE)
- Problem-Based Clinical Learning exercises with supporting medical imaging, surgical and pathological correlation

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### Contact

William B. Zucconi, DO
Assistant Clinical Professor of Radiology, Division of Neuroradiology
Yale University School of Medicine
william.zucconi@yale.edu

### Discussion/Future Plans

Selected References:

6. DeBernardo, E., and Mark JW Lee. “What are the learning affordances of 3D virtual environments?: an environment that capitalizes upon natural aspects of human perception by extending visual information in three spatial dimensions,” may supplement this information with other stimuli and temporal changes and enables the user to interact with the displayed data”. These technologies may be employed with standard PC hardware (desktop VLEs).