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Medical Students in Microscopic Anatomy and Pathology Laboratories: Design of an E-Learning Histology and Histopathology Atlas as an Evolving Response to Interdisciplinary Pre-Clinical Curricular Needs


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E-learning, also known as computer-assisted learning, successfully bridges anatomical knowledge and transferrable skills, such as critical analysis, teamwork, and communication. Several institutions have integrated histology and physiology in team based laboratory approaches, but integration of histology and pathology instruction has been done to a lesser extent. Our aim was to develop an e-learning atlas that integrates microanatomy and pathology laboratories for an interdisciplinary medical curriculum. A multidisciplinary team developed an online atlas (microanatomyatlas.com) that includes a library of histology and histopathology images. Traditional laboratory manual instructions and study objectives were linked to specific labeled images and made interactive to allow for self-testing. Clinical case studies involving a disease entity were incorporated, which allows students to toggle between normal as well as the pathological slides as they apply their clinical reasoning skills. Data is being collected on the number and frequency of students using the atlas. Also, a detailed survey to assess student satisfaction and learning will be administered. Our preliminary data so far shows that student feedback has been positive and an e-learning atlas integrating microanatomy and pathology laboratory may be an essential tool that guides the studies and enhances the performance of medical students.

Background

Computer-assisted learning, also known as e-learning, has been successfully implemented to educate students in anatomical knowledge as well as transferrable skills, such as critical analysis, teamwork, leadership and communication [1]. E-learning allows students to self-study material at their own pace and provides a platform for team-based laboratory learning. Several institutions have already integrated histology and physiology in team based laboratory learning [2, 3], but integration of histology and pathology instruction has been done to a lesser extent.

Objectives

Our aim was to develop an e-learning atlas that integrates microanatomy and pathology instruction for an interdisciplinary pre-clinical medical curriculum.

- A multidisciplinary team of teaching faculty and students developed the **MicroAnatomy Atlas (MAA)** (microanatomyatlas.com), which includes a library of histology and pathology images.
- Traditional laboratory manual instructions and study objectives [3, 4] were added to a digital interface and made interactive by linking them to specific labeled images configured for self-testing.

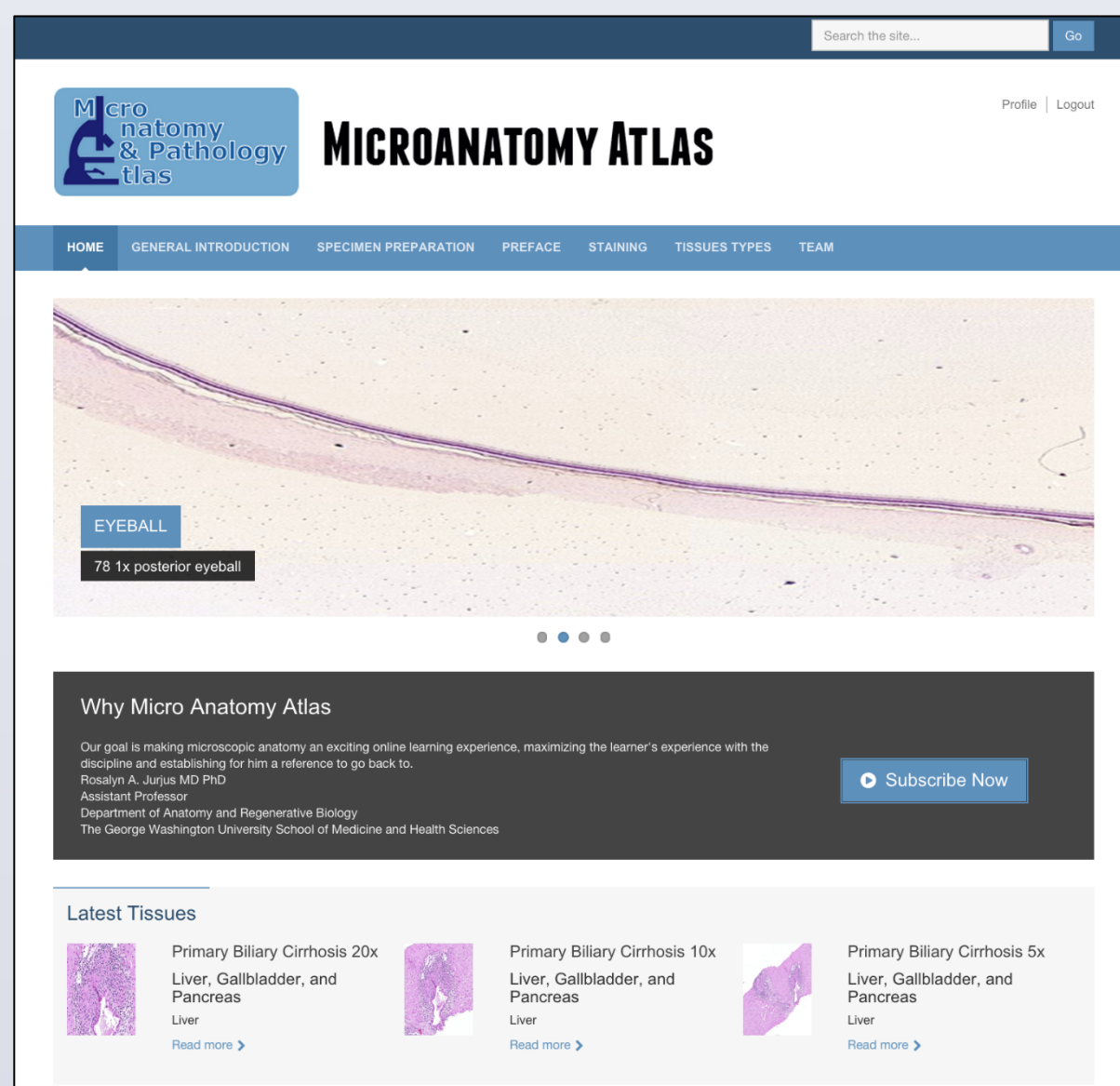


Fig. 1: A screenshot of the MAA home page

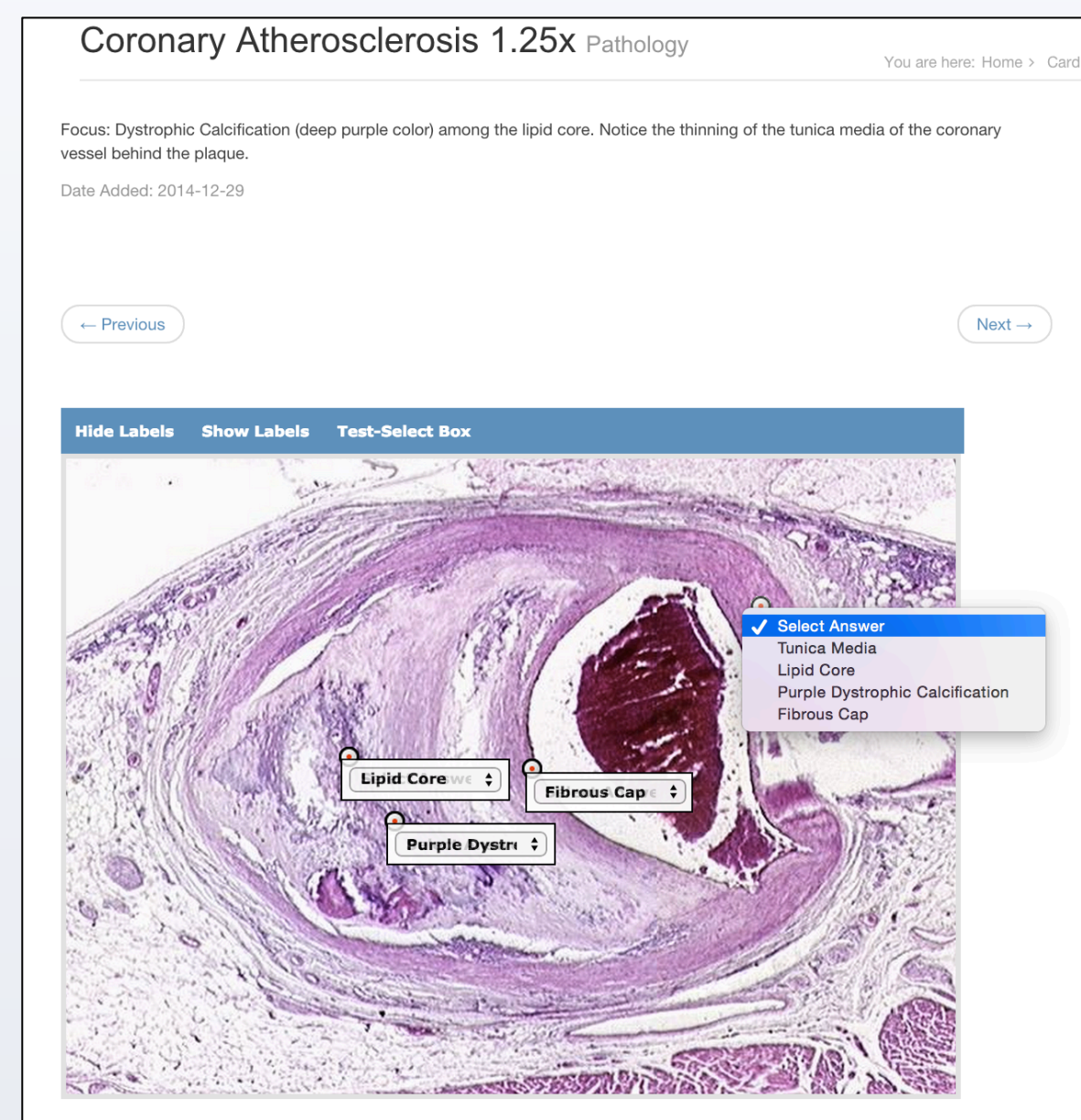


Fig. 2: A screenshot of the self-testing feature on the MAA

Methods

13 consenting first-year medical students at a large, urban medical school completed a 7-question, modified Likert scale evaluation prepared by the anatomy and pathology departments to assess the impact of this new teaching tool in the curriculum.

- Students were asked for feedback about the MAA as a whole and, in particular, the cardiovascular histology and pathology images.

Results

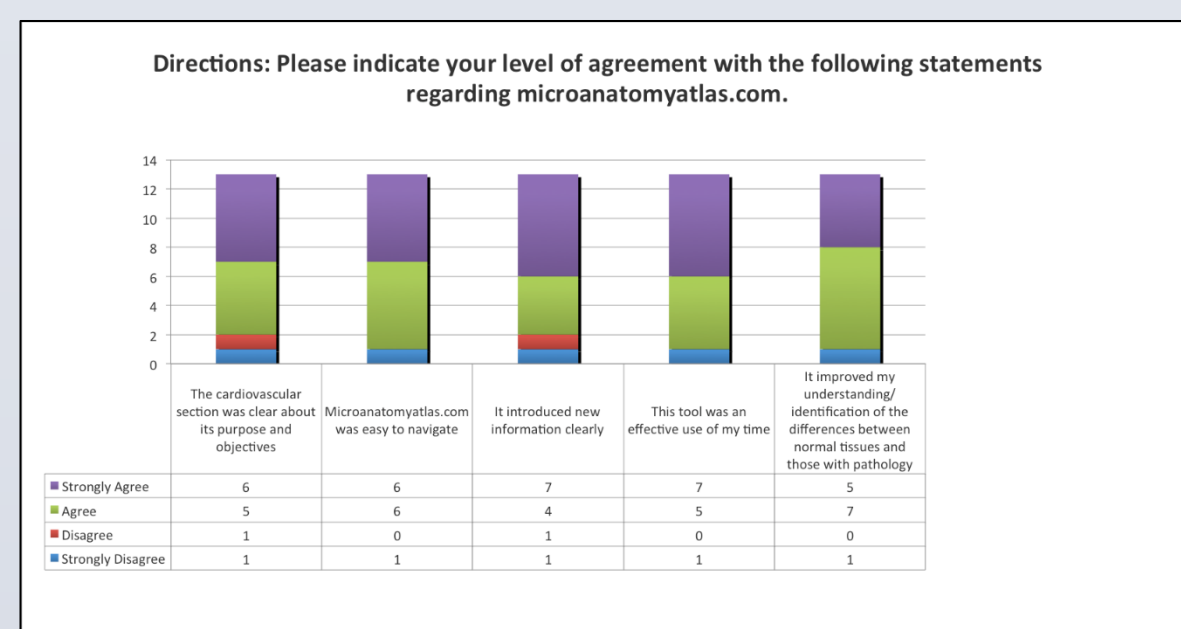


Fig. 3: Student responses toward the MAA and specifically the cardiovascular section show it to be a useful learning aid (n=13).

Results (continued)

- 92% of students reported that the MAA was an easy and effective study tool that positively improved their understanding of both histology and pathology.

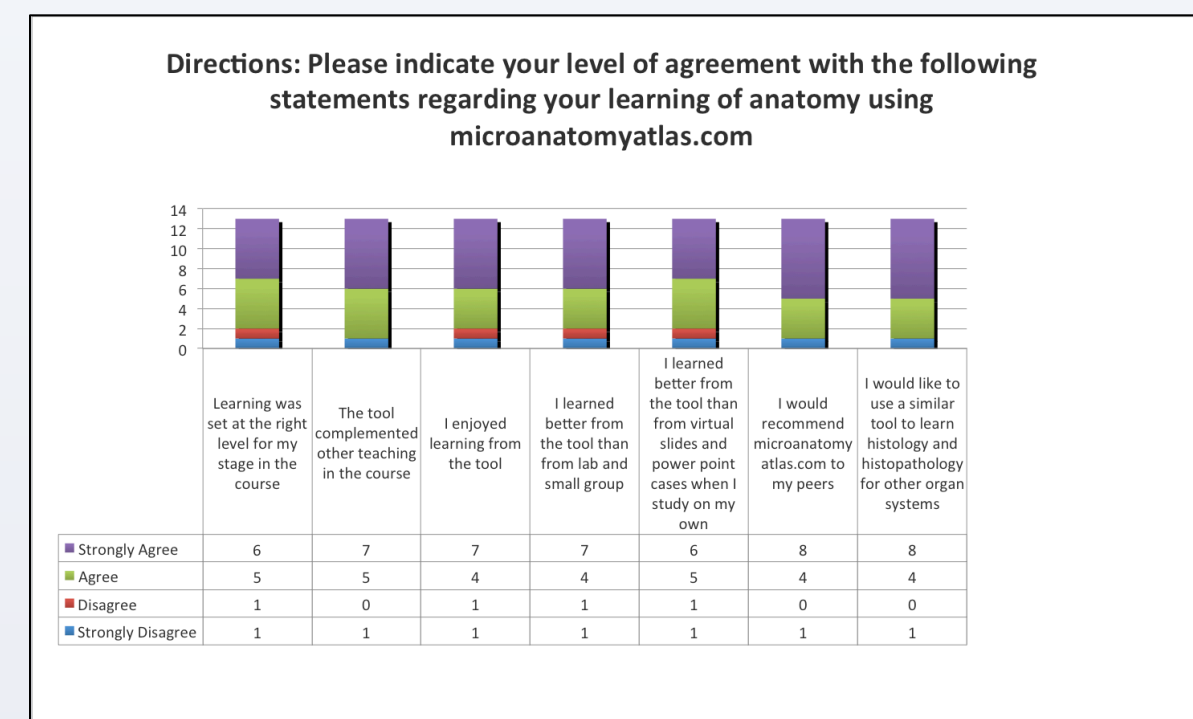


Fig. 4: Student responses toward the MAA shows interest in continuing use of the online tool in upcoming organ systems (n=13).

- 92% of students were in favor of using the tool again in the future with 62% being strongly in favor of further use.
- 92% of students also stated they would advise their peers to use the MAA.
- Data shows that the MAA is positively correlated with material from lectures and that the atlas is well suited for the level of proficiency of the students.

Discussion

Preliminary data shows positive student interest and enthusiasm for the MAA as a useful tool in histology and pathology education.

- Most students who used the website were strongly in favor of MAA as an effective e-learning aid to the histology and pathology curriculum and planned on using it in upcoming organ systems.
- Students commented specifically on the self-testing feature, noting it was among their favorite features of the MAA. Additionally, they requested its expansion in future upgrades.

"The atlas is not better than the one on one attention of a professor. But often in micro lab there are not enough professors to answer all of your questions and this website fills that void."

Fig. 5: A student's comment on the MAA as a whole

Conclusion

The MicroAnatomy Atlas has proved to be an effective and efficient tool for self-study of histology and pathology of the cardiovascular system.

- Most of the students who used the MAA enjoyed using the atlas and found it to be a productive use of study time that they would recommend to their peers.
- In the future, we plan on expanding the pathology library of the MAA to include pathology images from the remaining organ systems, as well as clinical case studies.
- A similar modified Likert scale evaluation of the gastrointestinal histology and pathology section will be conducted.
- We will continue to improve the functionality and user-friendliness of this tool as we receive feedback from the growing number of students using the MAA.

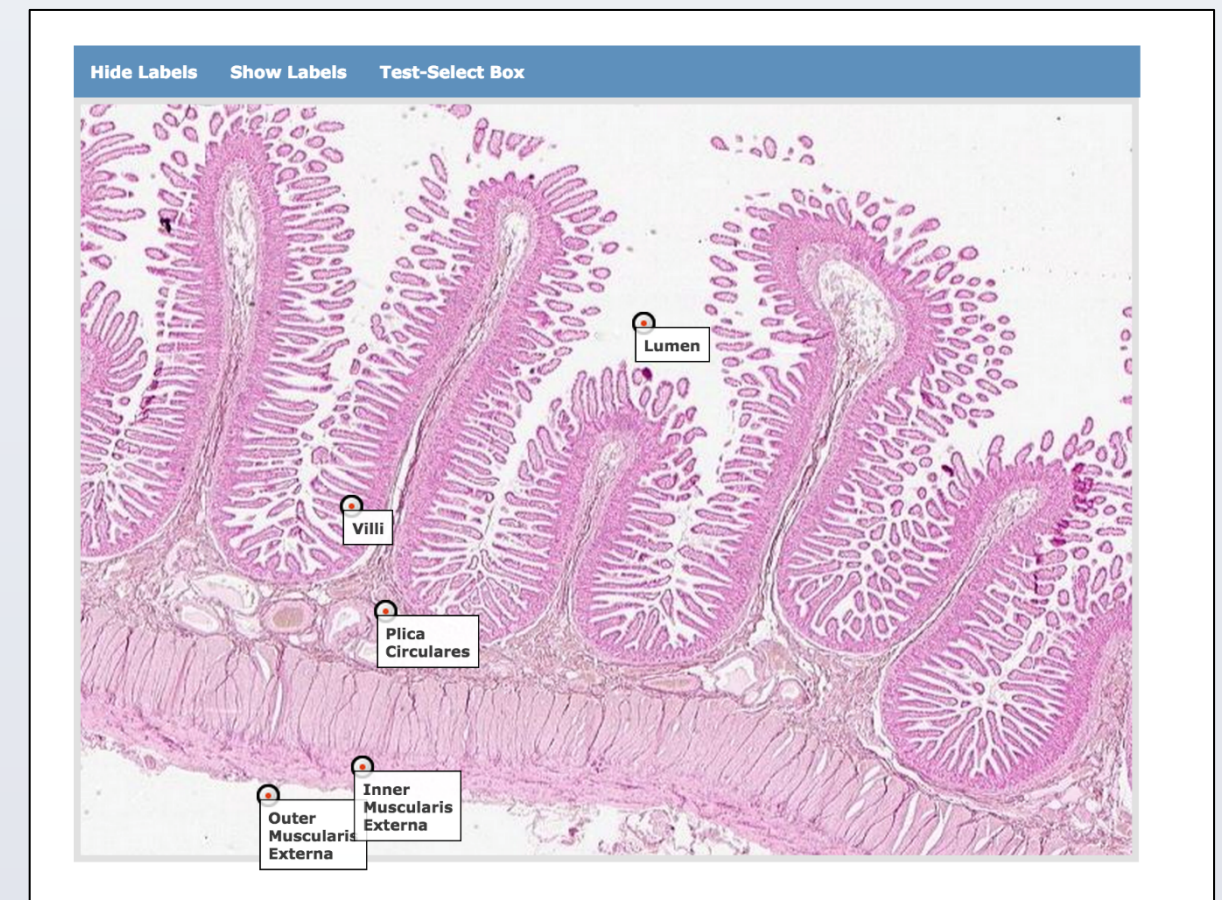


Fig. 6: A screenshot of jejunal histology on the MAA

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