

Affordable Learning Georgia Affordable Materials Grants Transformation Grants Final Report

General Information

Date: May 9, 2024

Grant Round: Round 22

Grant Number: 645

Institution Name(s): Augusta University

Project Lead: Karen Wiles

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Course Name(s) and Course Numbers:

Human Anatomy and Physiology I
BIOL 2111/2251 (numbering change in Summer 2023)

Semester Project Began: Spring 2023

Final Semester of Implementation: Spring 2024

Total Number of Students Affected During Project: 590 students across three semesters: 452 students in Spring 2023 and Fall 2024 prior to implementation, and 138 students in Spring 2024 following implementation.

1. Narrative

Materials Created:

Title: *Anatomy and Physiology I: An Interactive Histology Atlas*

Authors: Karen Wiles; Christina Wilson; Juan Manuel Ramiro-Diaz; Georgios Kallifatidis; and Soma Mukhopadhyay

Weblink: <https://pressbooks.pub/aandp1histologyatlasandworkbook/>

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Human Anatomy and Physiology I & II (BIOL 2111/2251 and 2252) are a two-semester sequence of courses offered by the Department of Biological Sciences at Augusta University and many USG institutions. Students enroll in these rigorous courses to fulfill prerequisites for many health science-focused undergraduate programs (e.g., nursing, dental, radiation therapy, respiratory therapy) and clinical graduate programs (e.g., physician assistant, dental, physical therapy, medical). The authors previously required the following texts, with the course-specific book requirements outlined in the table:

Lecture textbook: Marieb, E. N., & Hoehn, K. (2019). *Human Anatomy & Physiology* (11th ed.). Pearson.

Lab Manual: Marieb, E. N., Smith, L. A. (2019). *Human Anatomy & Physiology Laboratory manual* (12th ed.). Pearson.

This transformation project eliminates the use of the commercially available lab manual (referred to as “publisher book” in all reported data) through the creation of an open access interactive histology atlas. The laboratory component of both Anatomy and Physiology courses assesses student learning outcomes that focus on the identification of gross and microscopic structures within the context of the major organ systems of the human body. Students utilize commercially available anatomical models in their study of the gross anatomy of organ systems. Student mastery of gross anatomy is sufficiently supported using the anatomical models and the lecture textbook, and the authors did not feel the need to replicate these portions of a

traditional lab manual. Instead, the authors chose to focus on tissue histology, the content area that lacked sufficient representation in the lecture textbook.

Microscopic organ system anatomy is assessed through the recognition of tissue-types and organ-specific histological features using a compound light microscope and commercially available microscope slides. Due to varied sample preparation techniques (e.g., organ sectioning variation or differences in staining protocol), the appearance of representative tissue samples can have subtle or drastic changes in visual appearance between different batches of slides. Historically students have decreased success in learning outcomes related to microscopic anatomy, compared to those related to gross anatomy. The faculty hypothesized that this is, in part, impacted by a misalignment of the micrograph images in the lab manual with the appearance of individual student tissue slides. The images in the lab manual and lecture textbook often do not accurately represent the histological patterns seen in the student slides. The ill-matched images cause confusion for students which unnecessarily impedes student success in mastery of the tissue histology learning objectives.

While the authors believe that students should be introduced to the ideal tissue appearance, the use of a “textbook perfect” image provides students with an unrealistic prototype to use as they study histology on their own slide. As a result, the authors included multiple, high-resolution images of student slides to provide students with realistic, accessible reference images with which to conduct their study. The transformation materials were created using H5P interactive activities, allowing students to slide a vertical bar left to right to either reveal a hand-drawn illustration overlay or hide it to expose the underlying micrograph.

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This open access textbook utilizes H5P interactive elements to enhance student engagement and maximize student learning. An easy-to-use slide-bar on these H5P interactive activities gives students the ability to reveal or hide illustrations that overlay onto histological micrographs to help students visualize and more-easily identify cell- and tissue-level structures.

The authors anticipate that student savings will extend beyond the scope of Augusta University. There are two main suppliers of commercially available undergraduate-level histology slides, Carolina Biological Supply Co. and Ward’s Science. All images included in the atlas are tissue slides obtained from these suppliers. The authors predict that many A&P laboratory courses across the USG utilize slides from these same suppliers. It is our hope that other USG A&P faculty will utilize this open-access atlas to further increase student savings across the USG.

The authors are most delighted to be able to showcase the immense talent of several undergraduate students in this transformation project. The Medical Illustration Graduate

Program within the College of Allied Health Sciences at Augusta University is one of only four such programs in the country. The project included undergraduate students who aspire to careers as medical illustrators as part of the illustration team for this project. The authors were grateful to be able to showcase the impressive illustration talents of three aspiring medical illustrators in their recently published open-access histology atlas: Edna Martinez Sanchez, Jaylan Richardson, and Aislin Sparrow.

The authors feel strongly that student involvement in the project not only strengthens the pedagogical value of the materials created in this project, but also allows faculty to mentor student participants and support their unique academic journeys as they work towards professional goals. The authors felt strongly that this project offered these aspiring medical illustrators the unique opportunity to include their own published works in their creative portfolio as they seek acceptance to a Medical Illustration Graduate Program.

This transformation impacted instruction in significant ways. Prior to the transformation, teaching faculty would spend hours each week drawing histology sketches on the classroom whiteboard for use during lab sessions. This transformation allows all students to have access to the illustrations of the talented faculty and allows the faculty to spend more time helping students in other ways.

An additional accomplishment the authors would like to mention is their collaboration with the following scientific partners:

- **Motic Instruments USA Inc.**, who generously permitted the inclusion of Images of the Motic Panthera E2 compound light microscope in the book (<https://www.motic.com/>)
- **3B Scientific**, who generously permitted inclusion of images of the 3B Scientific Classic Unisex Human Torso Model – 14 Part (Item No. 1000190 [B13]) in the book. (www.3bscientific.com)

The authors are tremendously proud of the wide reach the materials have had thus far (as of May 13, 2024). Since publication (January 8, 2024) our open access histology atlas has generated 2960 total visitors (10,200 total page views) from the following avenues:

- 1199 visitors from Google
- 849 visitors from D2L (Augusta University's LMS)
- 39 visitors from OER Commons
- 20 visitors from Pressbooks Directory

Student Quotes

I liked the pictures a lot but sometimes there was things labeled that we didn't need to know so I'd have to keep looking back at the list which isn't that bad but it got annoying when studying for the practical.

I really enjoyed the pictures of each cell, tissues, neuron, etc. It really helped me to get a better idea of the cell under the microscope and having the drawings somewhat mimic the actual slide was helpful as well.

The histology atlas was an amazing resource for me! Between work and school I didn't have much time to spend in the open labs and the histology atlas bridged that gap for me. It really helped me study and understand the tissue types and my grades reflected how much time I studied with the atlas. I can't thank the authors enough for their time and effort put into the histology atlas. I give it a 10/10 and there is no reason or excuse to not have and or fund this for future students!

I liked how it provided detailed pictures with descriptions under them clarifying the details we need to know. I like how there were various examples of certain tissue types it allowed a more better learning experience.

2. Quantitative and Qualitative Measures

A. Uniform Measurements Questions

Student Opinion of Materials

Was the overall student opinion about the materials used in the course positive, neutral, or negative?

Total number of students affected in this project: 138 students

- Positive: 82-90 % of 78 respondents
- Neutral: 6-12 % of 78 respondents
- Negative: 3-6 % of 78 respondents

NOTE: values reported above represent ranges in student opinion responses for eight separate questions.

Student Learning Outcomes and Grades

Was the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters positive, neutral, or negative?

Student outcomes should be described in detail in Section 3b.

Choose One:

- ☐ Positive: Higher performance outcomes measured over previous semester(s)

- ☒ Neutral: Same performance outcomes over previous semester(s)
- ☐ Negative: Lower performance outcomes over previous semester(s)

Student Drop/Fail/Withdraw (DFW) Rates

Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?

Depending on what you and your institution can measure, this may also be known as a drop/failure rate or a withdraw/failure rate.

33.14 % of students, out of a total 230 students affected, dropped/failed/withdrew from the course in the final semester of implementation.

Choose One:

- ☐ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- ☒ Neutral: This is the same percentage of students with D/F/W than previous semester(s)
- ☐ Negative: This is a higher percentage of students with D/F/W than previous semester(s)

Important Note: the choice indicated above is based on data which shows a trend towards improved DFW rates (33.14% compared with 35.0%), but which is statistically indistinguishable from data prior to implementation.

B. Measures Narrative

Quantitative Data: DFW Rates

Student success metrics (ABC/DFW rates) showed a trend towards increased course retention and completion. A DFW rate of 33.14% was reported using the Interactive Histology Atlas compared with a 35.0% DFW rate using the lab manual commercially available through Pearson. However, the statistical power of this data is insufficient to determine statistical significance. Additional data must be collected in future semesters. One barrier observed in this project is the inability to fully assess the product given the short time of implementation. Further study is needed to fully assess the impact of the atlas on student success.

Quantitative Data: Lab Practical Exam Performance

Student exam performance data (% of students answering questions correctly) were collected for several histology questions on Lab Practical Exam 1 (11 questions) and Lab Practical Exam 2 (9 questions) in the BIOL 2111/2251 course (A&P I). Many co-variances impact the ability of the authors to discuss statistical significance. Data collection will continue for several more

semesters, and it is the authors hope that by increasing the number of data samples the authors will be able to discuss statistical significance. Nevertheless, student lab practical exam performance is indistinguishable between the two student groups (using textbook publisher lab manual and using interactive histology atlas). The authors are pleased to report that open access materials developed in this project (*Anatomy and Physiology I: An Interactive Histology Atlas*) yielded student success comparable to the for-cost publisher materials.

Qualitative Data: Student Satisfaction Survey

A student satisfaction survey was conducted anonymously in D2L, the Augusta University LMS. Students in the Spring 2024 semester were invited to submit feedback on the Interactive Histology Atlas through an anonymous survey. Students were asked to evaluate statements on a Likert scale (strongly disagree, disagree, neutral, agree, strongly agree).

Data from student respondents (78 respondents out of 138 total students) is compiled in the chart below. Negative responses (strongly disagree and disagree) were combined and reported as negative responses. Positive responses (strongly agree and agree) were combined and reported as positive responses. Values reported below represent ranges in student opinion responses for eight separate questions, and are as follows:

- Positive: 82-90 % of 78 respondents
- Neutral: 6-12 % of 78 respondents
- Negative: 3-6 % of 78 respondents

3. Sustainability Plan

The work produced in this project, *Anatomy and Physiology I: An Interactive Histology Atlas*, was created in Pressbooks, a company dedicated to open access educational materials. Pressbooks has generously agreed to host our book indefinitely under the condition that it remains OER (currently licensed as CC BY-NC-SA).

Weblink: <https://pressbooks.pub/aandp1histologyatlasandworkbook/>

4. Future Affordable Materials Plans

The authors of this transformation project have recently been awarded a second transformation grant through Affordable Learning Georgia Round 25 (Grant #712) which will allow the authors to continue this work through creation of an Interactive Histology Atlas for the 2nd course in the 2-course sequence (Anatomy and Physiology II).

5. Future Scholarship Plans

The authors have submitted a proposal to present this work at the 2024 Open Education Conference. Additionally, the authors plan to present this work at the 2025 annual meeting of the Human Anatomy and Physiology Society. Following further data collection, the

authors intend to publish their findings about the efficacy of open access materials in supporting student success.