Laboratory Manual for

Human Anatomy & Physiology

A HANDS-ON APPROACH

MAIN VERSION

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NORTHWEST MISSISSIPPI COMMUNITY COLLEGE

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To my mom, Judy—for your unending love and support, I am forever grateful. You are precious to my heart. I love you.

Love,
—Melissa

I would like to dedicate this book to my family and to all of the students that have taken our classes and thus helped us make this book the best it can be!

—Robin

To Bready, Audrey, and Luke—you are my whole world. Get your cups off of my table!

Love,
—Lisa (Mom)

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Melissa L. Greene is the Biology Department Chair at Northwest Mississippi Community College in Senatobia, MS. She earned her B.S. degree in biology from Christian Brothers University in Memphis, TN, and her M.S. in life science from the University of Maryland. Her primary research focus was neuroanatomy, which she conducted at the University of Tennessee Health Science Center. With 16 years of college teaching experience, Melissa has extensive experience teaching anatomy and physiology lecture and labs, introductory biology for nonmajors, and biology for majors both in the classroom and via an online forum. In addition, she advises students interested in pursuing careers in biology and the health professions. She is a member of the Human Anatomy and Physiology Society (HAPS) and the Mississippi Academy of Sciences. Melissa is on the board of the Northwest Faculty Association, where she serves as vice president. When not writing or teaching, she enjoys spending time with her family and traveling. Melissa actively supports the Memphis Oral School for the Deaf, where her niece was a student for four years.

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Robin H. Robison is in his twenty-ninth year of teaching anatomy and physiology at Northwest Mississippi Community College. He is finishing his fifth as the Director of Science Instruction for NWCC. Robin was the recipient of the 1997 Lamplighter Award for Excellence in Teaching at NWCC. He also received the Tate County Educator of the Year award in 1998. Robin is currently developing and teaching biology courses for NWCC's eLearning department. Robin's teaching style is very engaging and never boring. He inserts practical stories into his lectures that help the students relate to and understand the material. Robin is a product of the community college system, receiving his A.A. degree in biology from Northeast Mississippi Community College. He received his B.A. and M.S. degrees in biology from the University of Mississippi. Robin is a member of the Human Anatomy and Physiology Society.

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Lisa C. Strong is the Biology Laboratory Coordinator and a full-time instructor at Northwest Mississippi Community College. She also began her own college career at Northwest before transferring to Delta State University, where she received her B.S. in biology education. She earned her master's degree from the University of Mississippi in the spring of 2003. She has taught courses in human anatomy and physiology, microbiology, and general biology for 15 years. She has always had a passion for teaching and tries to instill a love for the sciences in her students. She is constantly seeking ways to engage her students through the use of innovative technology in the classroom. She is member of the Human Anatomy and Physiology Society.

Preface

After trying different A&P lab manuals over the years with varying success, we decided to write our own lab manual because it was clear the needs of our students were changing. As digital natives who represented a wide diversity of learning styles, our students needed a variety of learning modes and technology to help them prepare for lab and get the most out of their lab time.

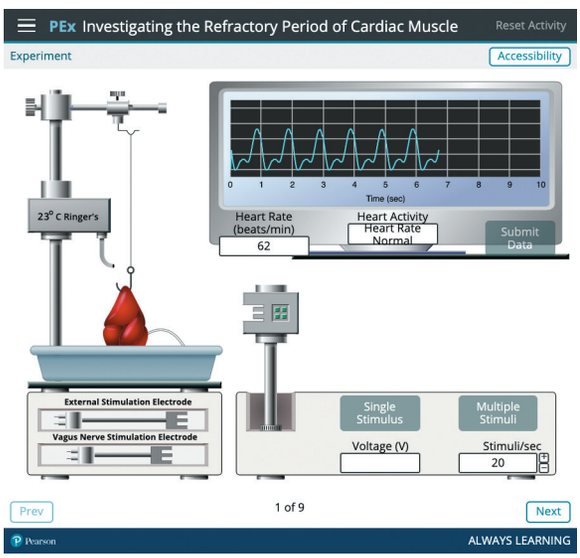
Key Features

We developed several special features in our lab manual that provide students with different ways of preparing for lab and maximizing their learning during lab time:

- **A rich variety of pre-lab assignments** including multiple-choice and short-answer questions, coloring, drawing, labeling, and watching pre-lab videos provide students with different learning modes to help them better prepare for lab. The pre-lab assignments are not in-depth topic studies but rather a superficial overview that can be completed in a relatively short time. We know that not all instructors will cover every activity within a lab exercise, so we have broken down the pre-lab assignments by activities. This will allow the instructors the freedom to decide which activities they want their students to complete. Pre-lab assignments are also available as **auto-gradable pre-lab assignments in Mastering A&P**. Having students who are prepared for lab will make better use of instructional time.
- **Over 100 specially commissioned photos of anatomical models** from Altay, Denoyer-Geppert, 3B Scientific, and Ward's Science help students identify and locate key anatomical structures and landmarks. In addition, some exercises include **side-by-side photos of cadavers and anatomical models** for easy visual comparison.
- **Over 50 lab videos**, Practice Anatomy Lab 3.1 (PAL) and animations featured in selected pre-lab assignments and lab activities maximize student learning by reviewing key A&P concepts and lab procedures. Each lab video and media have been specially called out in the lab manual via a screenshot for easy reference.

The lab videos, PAL and animations can be assigned in Mastering and are also available in the Study Area of Mastering A&P.

- Please see the **Quick Reference** on the inside cover of this lab manual for a list of the lab videos and animations for each activity.
- **Updated PhysioEx 10.0 Laboratory Simulations in Physiology** provides newly formatted exercises in HTML for increased stability, web browser flexibility, and improved accessibility. The 12 Exercises contain more than 60 easy-to-use laboratory simulation activities that complement or replace wet labs, including those that are expensive or time-consuming to perform in class. Each activity includes objectives, an introduction, a pre-lab quiz, the experiment, a post-lab quiz, review sheet questions, and a lab report that students can save as a PDF and print and/or e-mail to their instructor. The online format with easy step-by-step instructions includes everything students need in one convenient place.



Each PhysioEx exercise and activity is referenced in the lab manual; students are then directed to access them in the Study Area of Mastering A&P. Pre-lab and post-lab quizzes and review sheets for PhysioEx are assignable in Mastering A&P.

PhysioEx 10.0 includes the following features:

- Input data variability allows students to change variables and test various hypotheses for the experiments.
- Step-by-step instructions put everything students need to do to complete the lab in one convenient place. Students gather data, analyze results, and check their understanding, all on screen.
- Stop & Think Questions and Predict Questions help students think about the connection between the activities and the physiological concepts they demonstrate.
- Greater data variability in the results reflects more realistically the results that students would encounter in a wet lab experiment.
- Pre-lab and post-lab quizzes and short-answer review sheets are offered to help students prepare for and review each activity.
- Students can save their lab report as a PDF, which they can print and/or e-mail to their instructor.
- A Test Bank of assignable pre-lab and post-lab quizzes for use with TestGen or a course management system is provided for instructors, in the Instructor Resources in Mastering.

PhysioEx 10.0 topics include the following:

- Exercise 1: Cell Transport Mechanisms and Permeability. Explores how substances cross the cell membranes. Topics include simple and facilitated diffusion, osmosis, filtration, and active transport.
- Exercise 2: Skeletal Muscle Physiology. Provides insights into the complex physiology of skeletal muscle. Topics include electrical stimulation, isometric contractions, and isotonic contractions.
- Exercise 3: Neurophysiology of Nerve Impulses. Investigates stimuli that elicit action potentials, stimuli that inhibit action potentials, and factors affecting the conduction velocity of an action potential.
- Exercise 4: Endocrine System Physiology. Investigates the relationship between hormones and metabolism, the effect of estrogen replacement therapy, the diagnosis of diabetes, and the relationship between the levels of cortisol and adrenocorticotropic hormone and a variety of endocrine disorders.
- Exercise 5: Cardiovascular Dynamics. Examines vessel resistance and pump (heart) mechanics.
- Exercise 6: Cardiovascular Physiology. Examines variables influencing heart activity. Topics include setting up and recording baseline heart activity, the refractory period of cardiac muscle, and an investigation of factors that affect heart rate and contractility.
- Exercise 7: Respiratory System Mechanics. Investigates physical and chemical aspects of pulmonary function. Students collect data simulating normal lung volumes. Other activities examine factors such as airway resistance and the effect of surfactant on lung function.
- Exercise 8: Chemical and Physical Processes of Digestion. Examines factors that affect enzyme activity by manipulating (in compressed time) enzymes, reagents, and incubation conditions.
- Exercise 9: Renal System Physiology. Stimulates the function of a single nephron. Topics include factors influencing glomerular filtration, the effect of hormones on urine function, and glucose transport maximum.
- Exercise 10: Acid-Base Balance. Topics include respiratory and metabolic acidosis/alkalosis and renal and respiratory compensation.
- Exercise 11: Blood Analysis. Topics include hematocrit determination, erythrocyte sedimentation rate determination, hemoglobin determination, blood typing, and total cholesterol determination.
- Exercise 12: Serological Testing. Investigates antigen–antibody reactions and their role in clinical tests used to diagnose a disease or an infection.

- **Post-lab assessments** are designed to check students' understanding of the material presented in the lab exercise and, like the pre-lab, use a variety of questions best suited to assess students' understanding of the material. When appropriate, additional anatomical model or cadaver images (not identical to those in the procedure) are used. Each post-lab assessment ends with **Apply What You Learned** questions. These are clinical application–type questions that require students to use critical thinking skills to relate each lab to an overall understanding of how body systems work together.

- **Correlates with Amerman's *Human Anatomy & Physiology***. As A&P instructors, we have noticed that students often are unable to correlate the lab manual to the textbook. For example, the numbering of the lab exercises and textbook chapters

typically do not correspond. With our laboratory manual, we purposely organized the lab exercises so they correspond to the chapters of the textbook we use, *Human Anatomy & Physiology* by Erin Amerman. So when you are working on Chapter 19 (Blood) from the Amerman textbook, Lab exercise 19 in our lab manual will be the blood lab as well. Terminology and most of the illustrations match the Amerman textbook. However, educators and students not using Amerman's textbook will still find our exercises applicable and effective.

- **Affordability** is key because we know that for students, finances may be an issue. That is why we have worked hard to provide this high-quality lab manual and premium digital content at an affordable price. We also know that students are not the only ones dealing with financial issues. Many departments have experienced budget cuts and lack of funds. We have included many cost-effective lab activities in our lab manual with information in the Instructor Guide on where to purchase the materials used. *Practice Anatomy Lab* is a virtual study and practice tool that includes a wealth of photos of models and cadavers that otherwise might not be accessible to all students. We also have included *PhysioEx* activities to supplement or replace the expensive physiology equipment that is lacking in many laboratories.
- **Three versions** are offered. *Laboratory Manual for Human Anatomy & Physiology: A Hands-on Approach* is available in three versions for your students: Main, Cat, and Pig. The Cat and Pig versions are identical to the Main version except that they include seven additional cat dissection and nine additional fetal pig dissection exercises, respectively, at the back of the lab manual.
- **Custom options** are available. If a customized version of our lab manual is desired, customization *by activity level* is now available via the Pearson Custom Library. Instructors can easily select which activities they want and/or add their own original material to their custom lab manual.

Mastering A&P

Mastering A&P is an online learning and assessment system proven to help students learn. It helps instructors maximize lab time with customizable, easy-to-assign, automatically graded assessments that motivate students to learn outside class and arrive prepared for lab. The powerful gradebook provides unique insight into student and class performance.

Assignments in Mastering A&P

Instructors can easily assign the following in the Item Library in Mastering A&P. Please note that the Item Library for Greene is available in the stand-alone Mastering course for Greene. It is also available in the Book/Source menu in the Item Library for our 2-semester A&P textbooks by Amerman, Marieb, and Martini.

- **Pre-lab and post-lab quizzes for each activity** in the lab manual that test on the same content found in the pre-lab and post-lab assignments in the lab manual, excluding the color and draw questions.
- **"Roots to Remember" Coaching Activities –** Each exercise begins with an assignable activity that gives students practice learning and using word roots in context as they learn new A&P terms.
- **Chemistry Review Tutorials**
- **Art Labeling Activities**
- **"Apply What You Learned" –** Bloom's Taxonomy Level II Application/Analysis Questions
- **Lab Assistant Videos, Pre-lab Videos, and Animation Coaching Activities** maximize student learning by reviewing key A&P concepts and lab procedures.
- **Bone and Dissection Video Coaching Activities** help students to identify bones and learn how to do organ dissections.
- **Cat Dissection and Fetal Pig Dissection Video Coaching Activities** help students prepare for dissection and identify key anatomical structures. Each video includes one or two comparisons to human structures.
- **A&P Flix and BioFlix Animations** are 3D movie-quality anatomy and biology animations.
- **Practice Anatomy Lab 3.1 Test Bank** includes over 6000 multiple-choice and fill-in-the-blank questions.
- **PhysioEx 10.0 Assignments** include pre-lab and post-lab quizzes.
- **Clinical Scenario and Nurses Need Physiology Coaching Activities** provide students with additional practice in applying concepts to clinical situations.
- **Clinical Case Study Coaching Activities** increase problem-solving skills and prepare students for future careers in allied health. Corresponding **Teaching Strategies**, available in the Instructor Resources in Mastering A&P, enable

instructors to "flip" the classroom by providing valuable tips on when and how to use case studies. The case studies with worksheets are also available to students in the Study Area of Mastering.

Instructor Resources in Mastering A&P

The Instructor Resources include the following:

Computerized Test Bank for *every activity* and learning outcome that saves instructors time in creating lab quizzes and practicals. Instructors can create tests through TestGen by selecting questions from the provided Test Bank of multiple-choice and art-based questions, customizing questions as needed or adding in new question content. TestGen also allows randomization of the questions to produce up to 25 different versions of the same test. The Test Bank is also available in Microsoft Word format.

Instructor Guide contains instructions for setting up the laboratory activity; where to purchase lab materials; time allotments for each activity; learning objectives for each Exercise and answers to the pre-lab assignments, activity questions, and post-lab assessments, including the Apply What You Learned questions.

Lab Videos & Animations including A&P Flix and Bio Flix 3D Animations, Big Picture Animations, Bone & Dissection Videos, Cat Dissection Videos, Fetal Pig Dissection Videos, Get Ready for A&P Video Tutors, IP Anatomy Review Animations, Lab Assistant Videos, and Pre-lab Videos.

Practice Anatomy Lab Instructor Resources include PAL 3.1, animations, all images from PAL in PowerPoint and JPEG formats, PAL Test Bank, and PAL Lab Guide Answer Key.

PhysioEx Instructor Resources include PEx 10.0 and PhysioEx Test Bank.

Alternative Data Acquisition Instructions include instructions and exercises for BIOPAC, PowerLab, iWorx, and Intelitool.

Clinical Case Studies include case studies and worksheets to increase problem-solving skills and prepare students for future careers in allied health. **Teaching Strategies** for each case include introduction to the case, student learning objectives, prerequisites, and tips for how to use and assign the case in your course and "flipped classroom." The case studies and worksheets are also available to students in the Study Area of Mastering.

Study Area in Mastering

Students get access to the following study tools in the Study Area of Mastering A&P:

- **Lab Assistant Videos, Pre-lab Videos, Bone and Dissection Videos and Animations** are integrated into each lab exercise for quick, easy access.
- **Practice Anatomy Lab 3.1 (PAL 3.1)**, a virtual anatomy study and practice tool, gives students 24/7 access to the most widely used lab specimens, including the human cadaver, anatomical models, histology, cat, and fetal pig. PAL is easy to use and includes built-in audio pronunciations, rotatable bones, and simulated fill-in-the-blank lab practical exams. PAL 3.1 is accessible on all mobile devices, including smartphones, tablets, and laptops.
- **PAL 3.1 FLASHCARDS,** a popular student tool, allows students to create a customized, mobile-friendly deck of flashcards and quizzes based on images from PAL. Students generate personalized flashcards by selecting only those structures covered in their course.
- **PhysioEx™ 10.0 Laboratory Simulations in Physiology**
- **Pearson eText** (included with Mastering with eText for *Laboratory Manual for Human Anatomy & Physiology: A Hands-on Approach*), optimized for mobile in Pearson's fully accessible platform, seamlessly integrates videos and gives students access to their lab manual anytime, anywhere.

Class-Tested and Approved

Making this lab manual, including the text, the art, the photos, and the videos, was an intensive, collaborative process. Each draft of the manuscript was sent to A&P lab instructors and other content experts to evaluate the quality of the activities and accuracy, the art and photo program, and the overall pedagogical effectiveness. Our team worked closely together to analyze the feedback and determine which changes were necessary to improve the lab exercises. In addition, over 200 A&P instructors and 3000 students provided feedback through extensive focus groups and class-testing prior to publication.

Acknowledgments

It is hard to believe that this lab manual began seven years ago as an idea among friends on a trip home from a conference. We had a vision to create a laboratory manual that was user-friendly for the instructor and the student. Pooling our collective knowledge of anatomy and physiology, as well as what tools and techniques work in the lab setting, we set out on this journey five years ago, working diligently through holidays, weekends, and nights. However, none of this would have been possible without the support of our families, friends, and our incredible team at Pearson. They have seen us through the good and the bad times and have been patient with us during the trials and also celebrated the accomplishments. We are so grateful to have had such wonderful individuals in our lives during this journey.

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