

About the Authors



Elaine N. Marieb

After receiving her Ph.D. in zoology from the University of Massachusetts at Amherst, Elaine N. Marieb joined the faculty of the Biological Science Division of Holyoke Community College. While teaching at Holyoke Community College, where many of her students were pursuing nursing degrees, she developed a desire to better understand the relationship between the scientific study of the human body and the clinical aspects of the nursing practice. To that end, while continuing to teach full time, Dr. Marieb pursued her nursing education, which culminated in a Master of Science degree with a clinical specialization in gerontology from the University of Massachusetts. It is this experience that has informed the development of the unique perspective and accessibility for which her publications are known.

Dr. Marieb has given generously to provide opportunities for students to further their education. She funds the E. N. Marieb Science Research Awards at Mount Holyoke College, which promotes research by undergraduate science majors, and has underwritten renovation of the biology labs in Clapp Laboratory at that college. Dr. Marieb also contributes to the University of Massachusetts at Amherst, where she provided funding for reconstruction and instrumentation of a cutting-edge cytology research laboratory. Recognizing the severe national shortage of nursing faculty, she underwrites the Nursing Scholars of the Future Grant Program at the university.

In 2012 and 2017, Dr. Marieb gave generous philanthropic support to Florida Gulf Coast University as a long-term investment in education, research, and training for healthcare and human services professionals in the local community. In honor of her contributions, the university is now home to the Elaine Nicpon Marieb College of Health and Human Services.



Lori A. Smith

Lori A. Smith received her Ph.D. in biochemistry from the University of California at Davis. Before discovering her passion for teaching, she worked as a research scientist and project leader in the medical diagnostics industry. In 1999, she joined the faculty at American River College in the Biology Department, where she teaches anatomy and physiology and microbiology to students preparing for nursing or other allied health careers. Since 2005, she has coauthored Pearson's PhysioEx™: Laboratory Simulations in Physiology and has continued to coauthor several Pearson lab manuals. Dr. Smith has been named Instructor of the Year by the American River College Associated Student Body, and she is a member of the Human Anatomy and Physiology Society (HAPS) and California Academy of Sciences. When not teaching or writing, she enjoys spending time with her family: hiking, cycling, and kayaking.

Preface to the Instructor

The philosophy behind the revision of this manual mirrors that of all earlier editions. It reflects a still developing sensibility for the way teachers teach and students learn, informed by years of teaching the subject and by collecting suggestions from other instructors as well as from students enrolled in multifaceted healthcare programs. *Human Anatomy & Physiology Laboratory Manual* was originally developed to facilitate and enrich the laboratory experience for both teachers and students. This edition retains those same goals.

This manual, intended for students in introductory human anatomy and physiology courses, presents a wide range of laboratory experiences for students concentrating in nursing, physical therapy, pharmacology, respiratory therapy, and exercise science, as well as biology and premedical programs. The manual's coverage is intentionally broad, allowing it to serve both one- and two-semester courses, and it is available in versions that contain detailed guidelines for dissecting a cat or fetal pig laboratory specimen.

Basic Approach and Features

The generous variety of experiments in this manual provides flexibility that enables instructors to gear their laboratory approach to specific academic programs or to their own teaching preferences. The manual remains independent of any textbook, so it contains the background discussions and terminology necessary to perform all experiments. Such a self-contained learning aid eliminates the need for students to bring a textbook into the laboratory.

Each of the 46 exercises leads students toward a coherent understanding of the structure and function of the human body. The manual begins with anatomical terminology and an orientation to the body, which together provide the necessary tools for studying the various body systems. The exercises that follow reflect the dual focus of the manual—both anatomical and physiological aspects receive considerable attention. As the various organ systems of the body are introduced, the initial exercises focus on organization, from the cellular to the organ system level. As indicated by the table of contents, the anatomical exercises are usually followed by physiological experiments that familiarize students with various aspects of body functioning and promote the critical understanding that function follows structure. The numerous physiological experiments for each organ system range from simple experiments that can be performed without specialized tools to more complex experiments using laboratory equipment, computers, and instrumentation techniques.

Features



The dissection scissors icon appears at the beginning of activities that entail the dissection of isolated animal organs. In addition to the figures, isolated animal organs, such as the sheep heart and pig kidney, are employed to study anatomy because of their exceptional similarity to human organs.



Homeostasis is continually emphasized as a requirement for optimal health. Pathological conditions

are viewed as a loss of homeostasis; these discussions can be recognized by the homeostatic imbalance logo within the descriptive material of each exercise. This holistic approach encourages an integrated understanding of the human body. The homeostatic imbalance icon directs the student's attention to conditions representing a loss of homeostasis.



A safety icon notifies students that specific safety precautions must be observed when using certain equipment or conducting particular lab procedures. For example, when working with ether, students are to use a hood; and when handling body fluids such as blood, urine, or saliva, students are to wear gloves. All exercises involving body fluids (blood, urine, saliva) incorporate current Centers for Disease Control and Prevention (CDC) guidelines for handling human body fluids. Because it is important that nursing students in particular learn how to safely handle bloodstained articles, the manual has retained the option to use human blood in the laboratory. However, the decision to allow testing of human (student) blood or to use animal blood in the laboratory is left to the discretion of the instructor in accordance with institutional guidelines. The CDC guidelines for handling body fluids are reinforced by the laboratory safety procedures described on the inside front cover of this text, in Exercise 29: Blood, and in the *Instructor's Guide*. You can photocopy the inside front cover and post it in the lab to help students become well versed in laboratory safety.



Group Challenge activities are designed to enhance collaborative group learning and to challenge students to think critically, identify relationships between anatomical structures and physiological functions, and achieve a deeper understanding of anatomy and physiology concepts.



The BIOPAC[®] icon in a relevant exercise materials list signals the use of the BIOPAC[®] Student Lab System and alerts you to the equipment needed. BIOPAC[®] is used in Exercises 14, 18, 20, 21, 31, 33, 34, and 37. The instructions in the lab manual are for use with the BIOPAC[®] MP36/35 and MP45 data acquisition unit. Note that some exercises are not compatible with the MP45 data acquisition unit. For those exercises, the MP45 will not be listed in the Materials section. In this edition, the lab manual instructions are for use with BSL software 4.0.1 and above for Windows 10/8.x/7 or Mac OS X10.9–10.12. Refer to the Materials section in each exercise for the applicable software version. The Instructor Resources area of Mastering A&P provides the following additional support for alternative data acquisitions systems, including exercises that can be distributed to students:

- *BIOPAC[®] Instructions for the MP36 (or MP35/30) data acquisition unit* using BSL software versions earlier than 4.0.1 (for Windows and Mac) for Exercises 14, 18, 20, 21, 31, and 34
- *Powerlab[®] Instructions* for Exercises 14, 21, 31, 33, 34, and 37
- *iWorx[®] Instructions* for Exercises 14, 18, 21, 31, 33, 34, and 37
- *Intelitool[®] Instructions* for Exercises 14i, 21i, 31i, and 37i

- **Exercise Review Sheets** follow each laboratory exercise and provide space for recording and interpreting experimental results and require students to label diagrams and answer matching and short-answer questions. Selected questions can be assigned and automatically graded in Mastering A&P.
- **PhysioEx™ 9.1 Exercises**, located in the back of the lab manual and accessible through a subscription to Mastering A&P, are easy-to-use computer simulations that supplement or take the place of traditional wet labs safely and cost-effectively. These 12 exercises contain a total of 63 physiology laboratory activities that allow learners to change variables and test out various hypotheses for the experiments. PhysioEx™ allows students to repeat labs as often as they like, perform experiments without harming live animals, and conduct experiments that are difficult to perform because of time, cost, or safety concerns.

Updated Content in This Edition of the Lab Manual

Throughout the manual, the narrative text has been streamlined and updated to make the language more understandable and to better meet the needs of today's students. Additional highlights include the following:

- **Dozens of new full-color figures and photos** replace black-and-white line drawings in the Exercise Review Sheets. Selected labeling questions in the manual can be assigned in Mastering A&P.
- **New Clinical Application questions** have been added to the Exercise Review Sheets and challenge students to apply lab concepts and critical-thinking skills to real-world clinical scenarios.
- **Updated BIOPAC® procedures** are included in the manual for eight lab exercises for the BIOPAC® 4.0 software upgrade. Procedures for Intelitool®, PowerLab®, and iWorx® remain available in the Instructor Resources area of Mastering A&P.
- **New Mastering A&P visual previews** appear on the first page of each lab exercise, highlighting a recommended pre-lab video, a related image from Practice Anatomy Lab 3.1 (PAL 3.1), or a helpful animation.
- **New Mastering A&P assignment recommendations** are signaled at appropriate points throughout the manual to help instructors assign related auto-graded activities and assessments.
- **Extensive updates and improvements** have been made to each of the 46 laboratory exercises in the manual to increase clarity and reduce ambiguity for students. Art within the exercises, the narrative, as well as the questions and figures within the Review Sheets have been updated. For a complete list of content updates, please refer to the *Instructor's Guide for Human Anatomy & Physiology Laboratory Manual 13/e* (ISBN 9780134778839 or in the Instructor Resources area of Mastering A&P).

Highlights of Updated Content in Mastering A&P

Mastering A&P, the leading online homework, tutorial, and assessment system is designed to engage students and improve results by helping them stay on track in the course and quickly

master challenging anatomy and physiology concepts. Mastering A&P assignments support interactive features in the lab manual, including pre-lab video coaching activities; bone, muscle, and dissection videos; Dynamic Study Modules; *Get Ready for A&P*; plus a variety of Art Labeling questions, Clinical Application questions, and more. Highlights for this edition include the following:

- **8 new Pre-Lab Video Coaching Activities in Mastering A&P** (for a total of 18) focus on key concepts in the lab activity and walk students through important procedures. New pre-lab video titles include Preparing and Observing a Wet Mount, Examining a Long Bone, Initiating Pupillary Reflexes, Palpating Superficial Pulse Points, Auscultating Heart Sounds, and more.
- **New Cat and Fetal Pig Dissection Video Coaching Activities** help students prepare for dissection by previewing key anatomical structures. Each video includes one to two comparisons to human structures.
- **IMPROVED! Practice Anatomy Lab™ (PAL™ 3.1) is now fully accessible on all mobile devices**, including smartphones, tablets, and laptops. PAL is an indispensable virtual anatomy study and practice tool that gives students 24/7 access to the most widely used lab specimens, including human cadaver; anatomical models from leading manufacturers such as 3B Scientific, SOMSO, Denoyer-Geppert, Frey Scientific/Nystrom, Altay Scientific, and Ward's; histology; cat; and fetal pig. PAL 3.1 is easy to use and includes built-in audio pronunciations, rotatable bones, and simulated fill-in-the-blank lab practical exams.
- **New Customizable Practice Anatomy Lab (PAL) Flashcards** enable students to create a personalized, mobile-friendly deck of flashcards and quizzes using images from PAL 3.1. Students can generate flashcards using only the structures that their instructor emphasizes in lecture or lab.
- **New Building Vocabulary Coaching Activities** are a fun way for students to learn word roots and A&P terminology while building and practicing important language skills.
- **Expanded Dynamic Study Modules** help students study effectively on their own by continuously assessing their activity and performance in real time. Students complete a set of questions and indicate their level of confidence in their answer. Questions repeat until the student can answer them all correctly and confidently. These are available as graded assignments prior to class and are accessible on smartphones, tablets, and computers.
 - The Lab Manual Mastering A&P course now offers over 3000 Dynamic Study Module questions, shared with Marieb/Hoehn *Human Anatomy & Physiology*, 11th Edition.
 - Instructors can now remove questions from Dynamic Study Modules to better fit their course.
- **Expanded Drag-and-Drop Art Labeling Questions** allow students to assess their knowledge of terms and structures in the lab manual. Selected Exercise Review Sheet labeling activities in the manual are now assignable.

Please refer to the preceding pages for additional information about Mastering A&P and other resources for instructors and students.

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Last but not least, we wish to extend our sincere thanks to the many A&P students who have circulated through our lab classrooms and have used this lab manual over the years—you continue to inspire us every day! As always, we welcome your feedback and suggestions for future editions.



Elaine N. Marieb & Lori A. Smith

THIRTEENTH EDITION REVIEWERS

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