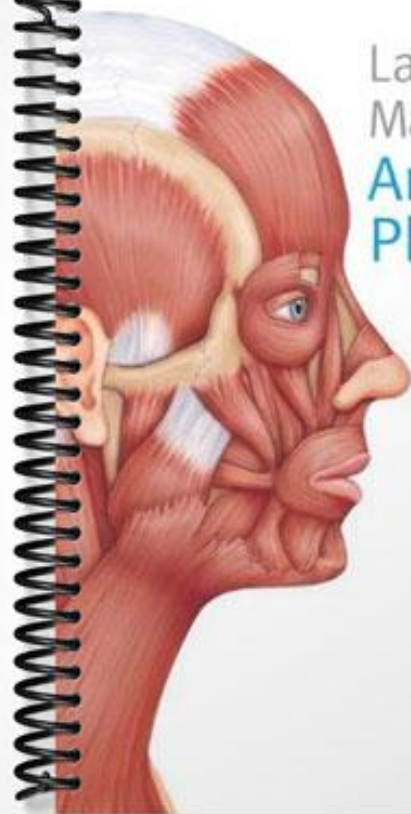


SOLUTIONS MANUAL



Laboratory
Manual for
**Anatomy &
Physiology**

eleventh edition

ELAINE N. MARIEB

Instructor Guide

Laboratory Manual for Anatomy & Physiology

Fourth Edition

ELAINE N. MARIEB, R.N., PH.D.

Holyoke Community College

Benjamin Cummings

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montréal Toronto
Delhi Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo



This work is protected by United States copyright laws and is provided solely for the use of instructors in teaching their courses and assessing student learning. Dissemination or sale of any part of this work (including on the World Wide Web) will destroy the integrity of the work and is not permitted. The work and materials from it should never be made available to students except by instructors using the accompanying text in their classes. All recipients of this work are expected to abide by these restrictions and to honor the intended pedagogical purposes and the needs of other instructors who rely on these materials.

Editor-in-Chief: Serina Beauparlant

Project Editor: Katy German

Managing Editor: Deborah Cogan

Production Manager: Michele Mangelli

Production Supervisor: Leslie Austin

Compositor: Cecelia G. Morales

Cover Design: Riezebos Holzbaur Design Group

Senior Manufacturing Buyer: Stacey Weinberger

Marketing Manager: Derek Perrigo

Cover Credit: Imagineering STA Media Services

Copyright © 2011, 2008, 2005 Pearson Education, Inc., publishing as Pearson Benjamin Cummings, 1301 Sansome St., San Francisco, CA 94111. All rights reserved. Manufactured in the United States of America. This publication is protected by Copyright and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. To obtain permission(s) to use material from this work, please submit a written request to Pearson Education, Inc., Permissions Department, 1900 E. Lake Ave., Glenview, IL 60025. For information regarding permissions, call (847) 486-2635.

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed in initial caps or all caps.

Benjamin Cummings
is an imprint of



www.pearsonhighered.com

ISBN 10: 0-321-67653-X; ISBN 13: 978-0-321-67653-5

1 2 3 4 5 6 7 8 9 10–SCI–13 12 11 10 09

Preface

Organization of this Instructor Guide

The Instructor Guide for the fourth edition of *Anatomy & Physiology Laboratory Manual* by Elaine N. Marieb features a wealth of information for the anatomy and physiology laboratory instructor.

Each exercise in this manual includes detailed directions for setting up the laboratory, comments on the exercise (including common problems encountered), some additional or alternative activities, and answers to the questions that appear in the text of the lab manual. (Answers to questions regarding student observations and data have not been included.)

Answers to the Review Sheets that are offered in the laboratory manual have been integrated to conveniently follow each exercise. In some cases several acceptable answers have been provided.



The time allotment at the beginning of each exercise, indicated by the hour glass icon, is an estimate of the amount of in-lab time it will take to complete the exercise, unless noted otherwise. If you are using multimedia, add the running time to the time allotted for a given exercise.



Suggested multimedia resources, indicated by the computer icon, are listed for each exercise. Format options include VHS, CD-ROM, and DVD. The resources are also listed by system in Multimedia Resources in Appendix A (page 160) of the guide. Information includes title, distributor, running time, and format. The key to format abbreviations is on the first page of this appendix. A listing of the multimedia resource distributors, along with address and contact information, can be found in Appendix B (page 169). In addition, a list of supply houses is in Appendix C (page 173).



Suggested *Interactive Physiology*[®] modules are listed at the beginning of relevant exercises and included in Multimedia Resources in Appendix A. Students are enabled to understand, rather than memorize, difficult physiological concepts with these detailed interactive animations, puzzles, quizzes, and other tools. Ten major topic areas are covered: Muscular System; Nervous System I: The Neuron—The Action Potential; Nervous System II: Synaptic Potentials and Neurotransmitters; Cardiovascular System; Respiratory System; Urinary System; Fluids, Electrolytes, and Acid/Base Balance; Endocrine System; Digestive System; and Immune System. Available on CD-ROM and at www.interactivephysiology.com.



Each exercise includes directions for preparing needed solutions, indicated by the test tube icon.

Laboratory Safety

Always establish safety procedures for the laboratory. Students should be given a list of safety procedures at the beginning of each semester and should be asked to locate exits and safety equipment. Suggested procedures are on page v, along with a student acknowledgment form on page vi. These pages may be copied and given to the students. Signed student acknowledgment forms should be collected by the instructor once the safety procedures have been read and explained and the safety equipment has been located.

Special precautions must be taken for laboratories using body fluids. Students should use only their own fluids or those provided by the instructor. In many cases, suitable alternatives have been suggested. All reusable glass and plasticware should be soaked in 10% bleach solution for 2 hours and then washed with laboratory detergent and autoclaved if possible. Disposable items should be placed in an autoclave bag for 15 minutes at 121°C and 15 pounds of pressure to ensure sterility. After autoclaving, items may be discarded in any disposal facility.

Disposal of dissection materials and preservatives should be arranged according to state regulations. Be advised that regulations vary from state to state. Contact your state Department of Health or Environmental Protection Agency or their counterparts for advice. Keep in mind that many dissection specimens can be ordered in formaldehyde-free preservatives; however, even formaldehyde-free specimens may not be accepted by local landfill organizations.

Anatomy & Physiology

Laboratory Safety Procedures

1. Upon entering the laboratory, locate exits, fire extinguisher, fire blanket, chemical shower, eye wash station, first aid kit, broken glass containers, and cleanup materials for spills.
2. Do not eat, drink, smoke, handle contact lenses, store food, and apply cosmetics or lip balm in the laboratory. Restrain long hair, loose clothing, and dangling jewelry.
3. Students who are pregnant, taking immunosuppressive drugs, or who have any other medical condition (e.g., diabetes, immunological defect) that might necessitate special precautions in the laboratory must inform the instructor immediately.
4. Wearing contact lenses in the laboratory is inadvisable because they do not provide eye protection and may trap material on the surface of the eye. If possible, wear regular eyeglasses instead.
5. Use safety glasses in all experiments involving liquids, aerosols, vapors, and gases.
6. Decontaminate work surfaces at the beginning and end of every laboratory period, using a commercially prepared disinfectant or 10% bleach solution. After labs involving dissection of preserved material, use hot soapy water or disinfectant.
7. Keep liquids away from the edge of the lab bench to help avoid spills. Liquids should be kept away from the edge of lab benches. Clean up spills of viable materials using disinfectant or 10% bleach solution.
8. Properly label glassware and slides.
9. Use mechanical pipetting devices; mouth pipetting is prohibited.
10. Wear disposable gloves when handling blood and other body fluids, mucous membranes, or nonintact skin, and/or when touching items or surfaces soiled with blood or other body fluids. Change gloves between procedures. Wash hands immediately after removing gloves. (Note: cover open cuts or scrapes with a sterile bandage before donning gloves.)
11. Place glassware and plasticware contaminated by blood and other body fluids in a disposable autoclave bag for decontamination by autoclaving or place them directly into a 10% bleach solution before reuse or disposal. Place disposable materials such as gloves, mouthpieces, swabs, and toothpicks that come into contact with body fluids into a disposable autoclave bag, and decontaminate before disposal.
12. To help prevent contamination by needle stick injuries, use only disposable needles and lancets. Do not bend needles and lancets. Needles and lancets should be placed promptly in a labeled puncture-resistant leakproof container and decontaminated, preferably by autoclaving.
13. Do not leave heat sources unattended.
14. Report all spills or accidents, no matter how minor, to the instructor.
15. Never work alone in the laboratory.
16. Remove protective clothing and wash hands before leaving the laboratory.

Laboratory Safety Acknowledgment Sheet

I hereby certify that I have read the safety recommendations provided for the laboratory and have located all of the safety equipment listed in Safety Procedure Number 1 of these procedures.

Student's Name _____

Course _____

Date _____

Instructor's Name _____

Adapted from:

Biosafety in Microbiological and Biomedical Laboratories. 1988. U.S. Government Printing Office, Washington, D.C. 20402.

Centers for Disease Control. 1989. "Guidelines for Prevention of Transmission of Human Immunodeficiency Virus and the Hepatitis B Virus to Health-Care and Public-Safety Workers." *MMWR*: 38 (S6).

_____. 1987. "Recommendations for Prevention of HIV Transmission in Health-Care Settings." *MMWR*: 36 (2s).

Johnson, Ted, and Christine Case. 2007. *Laboratory Experiments in Microbiology*, Eighth Edition. San Francisco, CA: Benjamin Cummings Publishing Co.

School Science Laboratories: A Guide to Some Hazardous Substances. 1984. U.S. Consumer Product Safety Commission. Washington, D.C. 20207.

U.S. Department of Health and Human Services Centers for Disease Control and Prevention and National Institutes for Health, Fifth Edition, 2007. U.S. Government Printing Office. Washington, D.C.
http://www.cdc.gov/OD/OHS/biosfty/bmbl5/BMBL_5th_Edition.pdf.

Contents

Exercises

Exercise 1	The Language of Anatomy	1
Exercise 2	Organ Systems Overview	4
Exercise 3	The Cell—Anatomy and Division	8
Exercise 4	Cell Membrane Transport Mechanisms	14
Exercise 5	Classification of Tissues	20
Exercise 6	The Skin (Integumentary System)	28
Exercise 7	Overview of the Skeleton	34
Exercise 8	The Axial Skeleton	39
Exercise 9	The Appendicular Skeleton	46
Exercise 10	Joints and Body Movements	51
Exercise 11	Microscopic Anatomy and Organization of Skeletal Muscle	56
Exercise 12	Gross Anatomy of the Muscular System	61
Exercise 13	Neuron Anatomy & Physiology	67
Exercise 14	Gross Anatomy of the Brain and Cranial Nerves	72
Exercise 15	Spinal Cord and Spinal Nerves	79
Exercise 16	Human Reflex Physiology	82
Exercise 17	The Special Senses	86
Exercise 18	Functional Anatomy of the Endocrine Glands	99
Exercise 19	Blood	104
Exercise 20	Anatomy of the Heart	110
Exercise 21	Anatomy of Blood Vessels	116
Exercise 22	Human Cardiovascular Physiology—Blood Pressure and Pulse Determinations	124
Exercise 23	Anatomy of the Respiratory System	130
Exercise 24	Respiratory System Physiology	135
Exercise 25	Functional Anatomy of the Digestive System	140
Exercise 26	Functional Anatomy of the Urinary System	148
Exercise 27	Anatomy of the Reproductive System	154

Appendices

Appendix A	Multimedia Resources	160
Appendix B	Multimedia Resource Distributors	169
Appendix C	Supply Houses	173

The Language of Anatomy

If time is a problem, most of this exercise can be done as an out-of-class assignment.



Time Allotment: (in lab): 1/2 hour.



Multimedia Resources: See Appendix B for a list of multimedia resource distributors.

The Human Body: The Ultimate Machine (CBS, 22 minutes, VHS)

The Incredible Human Machine (CBS, 60 minutes, VHS)

Interactive Atlas of Human Anatomy (ICON, CD-ROM)

Systems Working Together (WNS, 15 minutes, VHS)

Advance Preparation

1. Set out human torso models and have articulated skeletons available.
2. Obtain three preserved kidneys (sheep kidneys work well) and three bananas. Cut one of each in transverse section, one in longitudinal section (usually a sagittal section), and leave one uncut. Label the kidneys and put them in a demonstration area. You may wish to add a fourth kidney to demonstrate a frontal section.
3. The day before the lab, prepare gelatin or Jell-O® using slightly less water than is called for and cook the spaghetti until it is al dente. Pour the gelatin into several small molds and drop several spaghetti strands into each mold. Refrigerate until lab time.
4. Set out gelatin spaghetti molds and scalpel.

Comments and Pitfalls

1. Students will probably have the most trouble understanding proximal and distal; other than that there should be few problems.

Answers to Activity Questions

Activity 3: Practicing Using Correct Anatomical Terminology (p. 3)

1. The wrist is *proximal* to the hand.
2. The trachea (windpipe) is *anterior* or *ventral* to the spine.
3. The brain is *superior* or *cephalad* to the spinal cord.
4. The kidneys are *inferior* or *caudal* to the liver.
5. The nose is *medial* to the cheekbones.
6. The chest is *superior* to the abdomen.