



Human Anatomy & Physiology Laboratory



# **Anatomy and Physiology Laboratory Safety Guidelines**\*

- 1. Upon entering the laboratory, locate exits, fire extinguisher, fire blanket, chemical shower, eyewash station, first aid kit, containers for broken glass, and materials for cleaning up spills.
- 2. Do not eat, drink, smoke, handle contact lenses, store food, or apply cosmetics or lip balm in the laboratory. Restrain long hair, loose clothing, and dangling jewelry.
- **3.** Students who are pregnant, are taking immunosuppressive drugs, or have any other medical conditions (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. Soft contact lenses may absorb volatile chemicals. 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 lab 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 all liquids away from the edge of the lab bench to avoid spills. 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, and nonintact skin, and 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 have come into contact with body fluids into a disposable autoclave bag, and decontaminate before disposal.
- 12. To help prevent contamination by needlestick injuries, use only disposable needles and lancets. Do not bend the 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 before leaving the laboratory.

Biosafety in Microbiological and Biomedical Laboratories (BMBL), Fifth Edition. 2007. U.S. Government Printing Office. Washington, D.C. www.cdc.gov/od/OHS/biosfty/bmbl5/bmbl5toc.htm

Centers for Disease Control. 1996. "Universal Precautions for Prevention of Transmission of HIV and Other Bloodborne Infections." Washington, D.C. www.cdc.gov/ncidod/dhqp/bp\_universal\_precautions.html

Johnson, Ted, and Christine Case. 2010. *Laboratory Experiments in Microbiology*, Ninth Edition. San Francisco: Pearson Benjamin Cummings.

School Chemistry Laboratory Safety Guide. 2006. U.S. Consumer Product Safety Commission. Bethesda, MD. www.cpsc.gov/CPSCPUB/PUBS/NIOSH2007107.pdf

<sup>\*</sup>Adapted from:

# Human Anatomy & Physiology Laboratory Manual, Main Version, Global Edition

## **Table of Contents**

#### Cover

Anatomy and Physiology Laboratory Safety Guidelines\*

## Visual Walkthrough

Your time is valuable. Make the most of your time inside and outside the lab

Be Prepared: Learning in A&P Lab is an Active Process

Get 24/7 videos, coaching, and practice with Mastering A&P

Additional Support for Students & Instructors

Title Page

Copyright

About the Authors

Preface to the Instructor

Acknowledgments

Acknowledgments for the Global Edition

Contents

The Human Body: An Orientation

Exercise 1. The Language of Anatomy

- 1 Locating Body Regions
- 2 Practicing Using Correct Anatomical Terminology
- 3 Observing Sectioned Specimens
- 4 Identifying Organs in the Abdominopelvic Cavity
- 5 Locating Abdominopelvic Surface Regions

**Review Sheet** 

#### Exercise 2. Organ Systems Overview

- 1 Observing External Structures
- 2 Examining the Oral Cavity
- 3 Opening the Ventral Body Cavity
- 4 Examining the Ventral Body Cavity
- 5 Examining the Human Torso Model



**Review Sheet** 

## The Microscope And Its Uses

#### Exercise 3. The Microscope

- 1 Identifying the Parts of a Microscope
- 2 Viewing Objects Through the Microscope
- 3 Estimating the Diameter of the Microscope Field
- 4 Perceiving Depth
- 5 Preparing and Observing a Wet Mount

**Review Sheet** 

#### The Cell

#### Exercise 4. The Cell: Anatomy and Division

- 1 Identifying Parts of a Cell
- 2 Identifying Components of a Plasma Membrane
- 3 Locating Organelles
- 4 Examining the Cell Model
- 5 Observing Various Cell Structures
- 6 Identifying the Mitotic Stages
- 7 Chenille Stick Mitosis

**Review Sheet** 

#### Exercise 5. The Cell: Transport Mechanisms and Cell Permeability

- 1 Observing Diffusion of Dye Through Agar Gel
- 2 Observing Diffusion of Dye Through Water
- 3 Investigating Diffusion and Osmosis Through Nonliving Membranes
- 4 Observing Osmometer Results
- 5 Investigating Diffusion and Osmosis Through Living Membranes
- 6 Observing the Process of Filtration
- 7 Observing Phagocytosis

**Review Sheet** 

## Histology: Basic Tissues Of The Body

#### Exercise 6. Classification of Tissues

- 1 Examining Epithelial Tissue Under the Microscope
- 2 Examining Connective Tissue Under the Microscope
- 3 Examining Nervous Tissue Under the Microscope
- 4 Examining Muscle Tissue Under the Microscope

**Review Sheet** 

## The Integumentary System



#### Exercise 7. The Integumentary System

- 1 Locating Structures on a Skin Model
- 2 Identifying Nail Structures
- 3 Comparing Hairy and Relatively Hair-Free Skin Microscopically
- 4 Differentiating Sebaceous and Sweat Glands Microscopically
- 5 Plotting the Distribution of Sweat Glands
- 6 Taking and Identifying Inked Fingerprints

**Review Sheet** 

## The Skeletal System

## Exercise 8. Overview of the Skeleton: Classification and Structure of Bones and Cartilages

- 1 Examining a Long Bone
- 2 Examining the Effects of Heat and Hydrochloric Acid on Bones
- 3 Examining the Microscopic Structure of Compact Bone
- 4 Examining the Osteogenic Epiphyseal Plate

**Review Sheet** 

#### Exercise 9. The Axial Skeleton

1 Identifying the Bones of the Skull

Group Challenge Odd Bone Out

- 2 Palpating Skull Markings
- 3 Examining Spinal Curvatures
- 4 Examining Vertebral Structure
- 5 Examining the Relationship Between Ribs and Vertebrae
- 6 Examining a Fetal Skull

**Review Sheet** 

#### Exercise 10. The Appendicular Skeleton

- 1 Examining and Identifying Bones of the Appendicular Skeleton
- 2 Palpating the Surface Anatomy of the Pectoral Girdle and the Upper Limb
- 3 Observing Pelvic Articulations
- 4 Comparing Male and Female Pelves
- 5 Palpating the Surface Anatomy of the Pelvic Girdle and Lower Limb
- 6 Constructing a Skeleton

**Review Sheet** 

#### Exercise 11. Articulations and Body Movements

- 1 Identifying Fibrous Joints
- 2 Identifying Cartilaginous Joints



- 3 Examining Synovial Joint Structure
- 4 Demonstrating the Importance of Friction-Reducing Structures
- 5 Demonstrating Movements of Synovial Joints
- 6 Demonstrating Actions at the Hip Joint
- 7 Demonstrating Actions at the Knee Joint
- 8 Demonstrating Actions at the Shoulder Joint
- 9 Examining the Action at the TMJ

**Review Sheet** 

### The Muscular System

#### Exercise 12. Microscopic Anatomy and Organization of Skeletal Muscle

- 1 Examining Skeletal Muscle Cell Anatomy
- 2 Observing the Histological Structure of a Skeletal Muscle
- 3 Studying the Structure of a Neuromuscular Junction

**Review Sheet** 

#### Exercise 13. Gross Anatomy of the Muscular System

- 1 Identifying Head and Neck Muscles
- 2 Identifying Muscles of the Trunk
- 3 Identifying Muscles of the Upper Limb
- 4 Identifying Muscles of the Lower Limb
- 5 Review of Human Musculature
- 6 Making a Muscle Painting

**Review Sheet** 

#### Exercise 14. Skeletal Muscle Physiology: Frogs and Human Subjects

- 1 Observing Muscle Fiber Contraction
- 2 Inducing Contraction in the Frog Gastrocnemius Muscle
- 3 Demonstrating Muscle Fatigue in Humans
- 4 Electromyography in a Human Subject Using BIOPAC®

**Review Sheet** 

## The Nervous System

#### Exercise 15. Histology of Nervous Tissue

- 1 Identifying Parts of a Neuron
- 2 Studying the Microscopic Structure of Selected Neurons
- 3 Examining the Microscopic Structure of a Nerve

**Review Sheet** 

#### Exercise 16. Neurophysiology of Nerve Impulses: Frog Subjects

1 Stimulating the Nerve



**Review Sheet** 

#### Exercise 17. Gross Anatomy of the Brain and Cranial Nerves

- 1 Identifying External Brain Structures
- 2 Identifying Internal Brain Structures
- 3 Identifying and Testing the Cranial Nerves
- Group Challenge Odd (Cranial) Nerve Out

**Review Sheet** 

#### Exercise 18. Electroencephalography

- 1 Observing Brain Wave Patterns Using an Oscilloscope or Physiograph
- 2 Electroencephalography Using BIOPAC®

**Review Sheet** 

#### Exercise 19. The Spinal Cord and Spinal Nerves

- 1 Identifying Structures of the Spinal Cord
- 2 Identifying Spinal Cord Tracts
- 3 Identifying the Major Nerve Plexuses and Peripheral Nerves

**Review Sheet** 

#### Exercise 20. The Autonomic Nervous System

- 1 Locating the Sympathetic Trunk
- 2 Comparing Sympathetic and Parasympathetic Effects
- 3 Exploring the Galvanic Skin Response (Electrodermal Activity) Within a Polygraph Using BIOPAC®

**Review Sheet** 

#### Exercise 21. Human Reflex Physiology

- 1 Initiating Stretch Reflexes
- 2 Initiating the Crossed-Extensor Reflex
- 3 Initiating the Plantar Reflex
- 4 Initiating the Corneal Reflex
- 5 Initiating the Gag Reflex
- 6 Initiating Pupillary Reflexes
- 7 Initiating the Ciliospinal Reflex
- 8 Initiating the Salivary Reflex
- 9 Testing Reaction Time for Intrinsic and Learned Reflexes
- 10 Measuring Reaction Time Using BIOPAC®

**Review Sheet** 

#### Exercise 22. General Sensation

1 Studying the Structure of Selected Sensory Receptors



- 2 Determining the Two-Point Threshold
- 3 Testing Tactile Localization
- 4 Demonstrating Adaptation of Touch Receptors
- 5 Demonstrating Adaptation of Temperature Receptors
- 6 Demonstrating the Phenomenon of Referred Pain

**Review Sheet** 

#### Exercise 23. Special Senses: Anatomy of the Visual System

- 1 Identifying Accessory Eye Structures
- 2 Identifying Internal Structures of the Eye
- 3 Studying the Microscopic Anatomy of the Retina
- 4 Predicting the Effects of Visual Pathway Lesions

**Review Sheet** 

#### Exercise 24. Special Senses: Visual Tests and Experiments

- 1 Demonstrating the Blind Spot
- 2 Determining Near Point of Vision
- 3 Testing Visual Acuity
- 4 Testing for Astigmatism
- 5 Testing for Color Blindness
- 6 Testing for Depth Perception
- 7 Demonstrating Reflex Activity of Intrinsic and Extrinsic Eye Muscles
- 8 Conducting an Ophthalmoscopic Examination

**Review Sheet** 

#### Exercise 25. Special Senses: Hearing and Equilibrium

- 1 Identifying Structures of the Ear
- 2 Examining the Ear with an Otoscope (Optional)
- 3 Examining the Microscopic Structure of the Cochlea
- 4 Conducting Laboratory Tests of Hearing
- 5 Audiometry Testing
- 6 Examining the Microscopic Structure of the Crista Ampullaris
- 7 Conducting Laboratory Tests on Equilibrium

**Review Sheet** 

#### Exercise 26. Special Senses: Olfaction and Taste

- 1 Microscopic Examination of the Olfactory Epithelium
- 2 Microscopic Examination of Taste Buds
- 3 Stimulating Taste Buds
- 4 Examining the Combined Effects of Smell, Texture, and Temperature on Taste
- 5 Assessing the Importance of Taste and Olfaction in Odor Identification



6 Demonstrating Olfactory Adaptation

**Review Sheet** 

## The Endocrine System

#### Exercise 27. Functional Anatomy of the Endocrine Glands

- 1 Identifying the Endocrine Organs
- 2 Examining the Microscopic Structure of Endocrine Glands

Group Challenge Odd Hormone Out

**Review Sheet** 

#### Exercise 28. Endocrine Wet Labs and Human Metabolism

- 1 Determining the Effect of Pituitary Hormones on the Ovary
- 2 Observing the Effects of Hyperinsulinism

Group Challenge Thyroid Hormone Case Studies

**Review Sheet** 

## The Circulatory System

#### Exercise 29. Blood

- 1 Determining the Physical Characteristics of Plasma
- 2 Examining the Formed Elements of Blood Microscopically
- 3 Conducting a Differential WBC Count
- 4 Determining the Hematocrit
- 5 Determining Hemoglobin Concentration
- 6 Determining Coagulation Time
- 7 Typing for ABO and Rh Blood Groups
- 8 Observing Demonstration Slides
- 9 Measuring Plasma Cholesterol Concentration

**Review Sheet** 

#### Exercise 30. Anatomy of the Heart

- 1 Using the Heart Model to Study Heart Anatomy
- 2 Tracing the Path of Blood Through the Heart
- 3 Using the Heart Model to Study Cardiac Circulation
- 4 Examining Cardiac Muscle Tissue Anatomy

**Review Sheet** 

#### Exercise 31. Conduction System of the Heart and Electrocardiography

- 1A Recording ECGs Using a Standard ECG Apparatus
- 1B Electrocardiography Using BIOPAC®

**Review Sheet** 

Exercise 32. Anatomy of Blood Vessels



- 1 Examining the Microscopic Structure of Arteries and Veins
- 2 Locating Arteries on an Anatomical Chart or Model
- 3 Identifying the Systemic Veins
- 4 Identifying Vessels of the Pulmonary Circulation
- Group Challenge Fix the Blood Trace
- 5 Tracing the Pathway of Fetal Blood Flow
- 6 Tracing the Hepatic Portal Circulation

**Review Sheet** 

## Exercise 33. Human Cardiovascular Physiology: Blood Pressure and Pulse Determinations

- 1 Auscultating Heart Sounds
- 2 Palpating Superficial Pulse Points
- 3 Measuring Pulse Using BIOPAC®
- 4 Taking an Apical Pulse
- 5 Using a Sphygmomanometer to Measure Arterial Blood Pressure Indirectly
- 6 Estimating Venous Pressure
- 7 Observing the Effect of Various Factors on Blood Pressure and Heart Rate
- 8 Examining the Effect of Local Chemical and Physical Factors on Skin Color

**Review Sheet** 

#### Exercise 34. Frog Cardiovascular Physiology

- 1 Investigating the Automaticity and Rhythmicity of Heart Muscle
- 2 Recording Baseline Frog Heart Activity
- 3 Investigating the Refractory Period of Cardiac Muscle Using the Physiograph
- 4 Assessing Physical and Chemical Modifiers of Heart Rate
- 5 Investigating the Effect of Various Factors on the Microcirculation

**Review Sheet** 

#### Exercise 35. The Lymphatic System and Immune Response

- 1 Identifying the Organs of the Lymphatic System
- 2 Studying the Microscopic Anatomy of a Lymph Node, the Spleen, and a Tonsil

Group Challenge Compare and Contrast Lymphoid Organs and Tissues

3 Using the Ouchterlony Technique to Identify Antigens

**Review Sheet** 

## The Respiratory System

#### Exercise 36. Anatomy of the Respiratory System

- 1 Identifying Respiratory System Organs
- 2 Demonstrating Lung Inflation in a Sheep Pluck



3 Examining Prepared Slides of Trachea and Lung Tissue

**Review Sheet** 

#### Exercise 37. Respiratory System Physiology

- 1 Operating the Model Lung
- 2 Auscultating Respiratory Sounds
- 3 Measuring Respiratory Volumes Using Spirometers
- 4 Measuring the FVC and FEV1
- 5 Measuring Respiratory Volumes Using BIOPAC®
- 6 Visualizing Respiratory Variations
- 7 Demonstrating the Reaction Between Carbon Dioxide (in Exhaled Air) and Water
- 8 Observing the Operation of Standard Buffers
- 9 Exploring the Operation of the Carbonic AcidBicarbonate Buffer System

**Review Sheet** 

#### The Digestive System

#### Exercise 38. Anatomy of the Digestive System

- 1 Identifying Alimentary Canal Organs
- 2 Studying the Histologic Structure of the Stomach and the Esophagus-Stomach Junction
- 3 Observing the Histologic Structure of the Small Intestine
- 4 Examining the Histologic Structure of the Large Intestine
- 5 Identifying Types of Teeth
- 6 Studying Microscopic Tooth Anatomy
- 7 Examining Salivary Gland Tissue
- 8 Examining the Histology of the Liver

**Review Sheet** 

#### Exercise 39. Digestive System Processes: Chemical and Physical

- 1 Assessing Starch Digestion by Salivary Amylase
- 2 Assessing Protein Digestion by Trypsin
- 3 Demonstrating the Emulsification Action of Bile and Assessing Fat Digestion by Lipase
- 4 Reporting Results and Conclusions

Group Challenge Odd Enzyme Out

- 5 Observing Movements and Sounds of the Digestive System
- 6 Viewing Segmental and Peristaltic Movements

**Review Sheet** 

## The Urinary System

#### Exercise 40. Anatomy of the Urinary System

1 Identifying Urinary System Organs



- 2 Studying Nephron Structure
- 3 Studying Bladder Structure

Group Challenge Urinary System Sequencing

**Review Sheet** 

#### Exercise 41. Urinalysis

- 1 Analyzing Urine Samples
- 2 Analyzing Urine Sediment Microscopically (Optional)

**Review Sheet** 

#### The Reproductive System, Development, And Heredity

#### Exercise 42. Anatomy of the Reproductive System

- 1 Identifying Male Reproductive Organs
- 2 Penis
- 3 Seminal Gland
- 4 Epididymis
- 5 Identifying Female Reproductive Organs
- 6 Wall of the Uterus
- 7 Uterine Tube

**Review Sheet** 

#### Exercise 43. Physiology of Reproduction: Gametogenesis and the Female Cycles

- 1 Identifying Meiotic Phases and Structures
- 2 Examining Events of Spermatogenesis
- 3 Examining Meiotic Events Microscopically
- 4 Examining Oogenesis in the Ovary
- 5 Comparing and Contrasting Oogenesis and Spermatogenesis
- 6 Observing Histological Changes in the Endometrium During the Menstrual Cycle

**Review Sheet** 

#### Exercise 44. Survey of Embryonic Development

- 1 Microscopic Study of Sea Urchin Development
- 2 Examining the Stages of Human Development
- 3 Identifying Fetal Structures
- 4 Studying Placental Structure

**Review Sheet** 

#### Exercise 45. Principles of Heredity

- 1 Working Out Crosses Involving Dominant and Recessive Genes
- 2 Working Out Crosses Involving Incomplete Dominance
- 3 Working Out Crosses Involving Sex-Linked Inheritance



- 4 Exploring Probability
- 5 Using Blood Type to Explore Phenotypes and Genotypes
- 6 Using Agarose Gel Electrophoresis to Identify Normal Hemoglobin, Sickle Cell Anemia, and Sickle Cell Trait

**Review Sheet** 

## Surface Anatomy

#### Exercise 46. Surface Anatomy Roundup

- 1 Palpating Landmarks of the Head
- 2 Palpating Landmarks of the Neck
- 3 Palpating Landmarks of the Trunk
- 4 Palpating Landmarks of the Abdomen
- 5 Palpating Landmarks of the Upper Limb
- 6 Palpating Landmarks of the Lower Limb

**Review Sheet** 

#### Physioex 10.0 Computer Simulations

- Exercise 1. Cell Transport Mechanisms and Permeability
- Exercise 2. Skeletal Muscle Physiology
- Exercise 3. Neurophysiology of Nerve Impulses
- Exercise 4. Endocrine System Physiology
- Exercise 5. Cardiovascular Dynamics
- Exercise 6. Cardiovascular Physiology
- Exercise 7. Respiratory System Mechanics
- Exercise 8. Chemical and Physical Processes of Digestion
- Exercise 9. Renal System Physiology
- Exercise 10. Acid-Base Balance
- Exercise 11. Blood Analysis
- Exercise 12. Serological Testing

#### Credits

Index

The Metric System

