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Laboratory Manual for Anatomy & Physiology (5th Edition)

By Elaine N. Marieb

1. INTRODUCTION

This full-color laboratory manual is designed for instructors teaching a two-semester introductory anatomy and physiology course. It is suitable for programs that do not require the extensive range of laboratory exercises found in Marieb's other Human Anatomy & Physiology Lab Manuals (Cat, Fetal Pig, and Main). While compatible with various two-semester texts, its content is optimized for use with Marieb's *Anatomy & Physiology, Fifth Edition*.

The manual provides a structured approach to laboratory work, supporting student learning through practical exercises and visual aids.

2. KEY FEATURES

- **Full-Color Presentation:** The manual features a full-color design throughout, enhancing visual clarity for anatomical structures and histological slides.
- **Student-Friendly Design:** Includes checkboxes to assist students in tracking their progress through exercises and assignments.
- **Clear Objectives:** Each exercise begins with a complete list of objectives, guiding students on expected learning outcomes.
- **Updated Terminology:** Incorporates fully-updated terminology in accordance with *Terminologia Anatomica* and *Terminologia Histologica*.
- **Extensive Histology Atlas:** A comprehensive, full-color Histology Atlas is integrated within the manual for detailed microscopic study.
- **Integrated Review Sheets:** Provides review sheets designed to reinforce learning and aid in self-assessment.
- **New Art and Photos:** Features updated illustrations and photographs to enhance understanding of complex concepts in anatomy and physiology.

3. USING THE MANUAL

3.1. Preparing for Exercises

Before beginning any laboratory exercise, review the stated objectives and read through the entire procedure. Identify any materials or equipment required. Understanding the theoretical background for each exercise is crucial for effective learning.

3.2. Following Procedures

Perform each step of the exercise carefully as outlined in the manual. Pay close attention to diagrams and instructions. Record observations and data accurately in the designated spaces. The checkboxes provided can be used to mark completed steps or sections.

Name _____

Lab Time/Date _____

EXERCISE 6

The Skin (Integumentary System)

REVIEW SHEET

Basic Structure of the Skin

1. Complete the following statements by writing the appropriate word or phrase on the correspondingly numbered blank:

The two basic tissues of which the skin is composed are dense connective tissue, which makes up the dermis, and 1, which forms the epidermis. Most cells of the epidermis are 2. The protein 3 makes the dermis tough and leatherlike. The specialized cells that produce the pigments that contribute to skin color are called 4.

1. _____

2. _____

3. _____

4. _____

2. Four protective functions of the skin are _____

3. Using the key, choose all responses that apply to the following descriptions.

Key: stratum basale	stratum lucidum	reticular layer
stratum corneum	stratum spinosum	epidermis (as a whole)
stratum granulosum	papillary layer	dermis (as a whole)

_____ 1. layer containing sacs filled with fatty material or keratin subunits

_____ 2. consists entirely of dead cells

_____ 3. the more superficial dermis layer

_____ 4. avascular region

_____ 5. major skin area where derivatives (nails and hair) reside

_____ 6. epidermal region exhibiting the most mitoses

_____ 7. most superficial epidermal layer

- 8. has abundant elastic and collagenic fibers
- 9. region where melanocytes are most likely to be found
- 10. accounts for most of the epidermis

Figure 1: An example page from the manual, detailing an exercise on the integumentary system. This section includes questions and prompts for students to complete, reinforcing knowledge of skin anatomy and physiology.

3.3. Utilizing the Histology Atlas and Review Sheets

The integrated Histology Atlas serves as a visual reference for microscopic anatomy. Refer to it when studying tissues and cells. Complete the integrated Review Sheets after each exercise or unit to consolidate understanding and prepare for assessments. These sheets are designed for self-evaluation and reinforcement of key concepts.

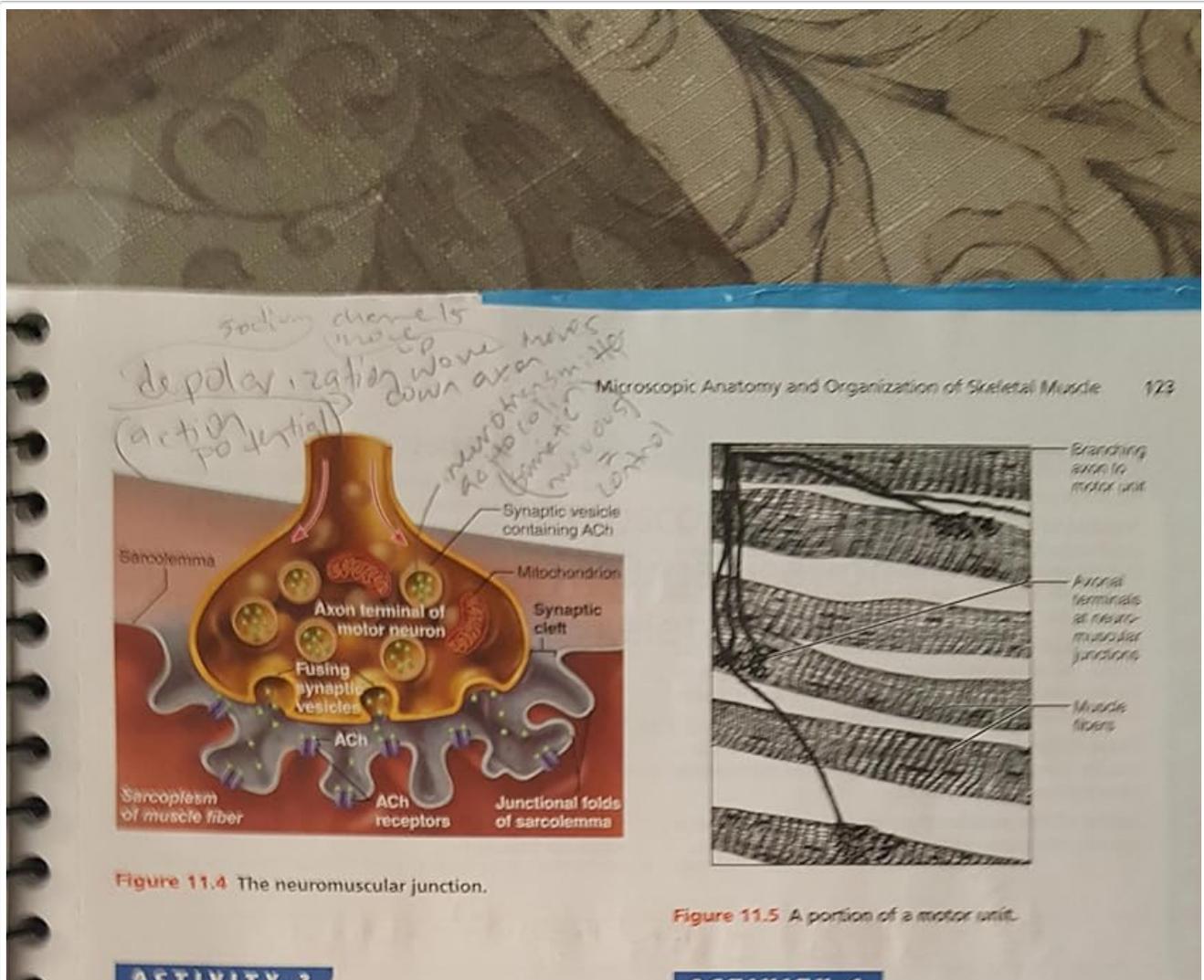


Figure 11.4 The neuromuscular junction.

Figure 11.5 A portion of a motor unit.

Observing the Structure of a Skeletal Muscle

Go to the appropriate microscope at the demonstration area and examine a slide showing a cross section of a skeletal muscle. Identify the muscle fibers, endomysium, perimysium, and epimysium, if visible (refer to Figure 11.3). ■

The Neuromuscular Junction

Skeletal muscle cells are always stimulated by motor neurons via nerve impulses. The junction between a nerve fiber (axon) and a muscle cell is called a **neuromuscular junction**, or **end plate** (Figure 11.4).

Each motor axon breaks up into many branches called *axonal terminals* as it nears the muscle, and each branch forms a neuromuscular junction with a single muscle cell. Thus a single neuron may stimulate many muscle fibers. Together, a neuron and all the muscle cells it stimulates make up the functional structure called the **motor unit** (Figure 11.5).

The neuron and muscle fiber membranes, close as they are, do not actually touch. They are separated by a small fluid-filled gap called the **synaptic cleft** (see Figure 11.4).

Within the axonal terminals are mitochondria and vesicles containing a neurotransmitter chemical called *acetylcholine* (ACh). When a nerve impulse reaches the axonal endings, some of the vesicles release their contents into the synaptic cleft. The ACh rapidly diffuses across the junction and combines with the receptors on the sarcolemma. If sufficient ACh is released, the permeability of the sarcolemma changes briefly, allowing more sodium ions to diffuse into the muscle fiber. If enough sodium enters the fiber, an action potential is generated along its length.

Studying the Structure of a Neuromuscular Junction

1. If possible, examine a three-dimensional model of skeletal muscle cells that illustrates the neuromuscular junction. Identify the structures just described.

2. Go to the demonstration area to examine a slide of skeletal muscle stained to show a portion of a motor unit. Identify the axonal fibers extending leaflike to the muscle cells. Follow one of the axonal fibers to its terminus to identify the oval-shaped axonal terminal. Compare your observations to the figures (Figure 11.5 and Plate 4 in the *Histology Atlas*). ■

Classification of Skeletal Muscles

Naming Skeletal Muscles

Remembering the names of the skeletal muscles is a monumental task, but certain clues help. Muscles are named on the basis of the following criteria:

- **Direction of muscle fibers:** Some muscles are named relative to some imaginary line, usually the midline of the body or the longitudinal axis of a limb bone. For example, the *rectus abdominis* is the straight muscle of the abdomen. The terms *rectus*, *transverse*, and *oblique* indicate that the muscle fibers run with, at right angles, or obliquely (respectively) to the imaginary line.
- **Relative size of the muscle:** When size is the criterion, terms such as *maximus* (largest), *minimus* (smallest), *longus* (long), and *brevis* (short) are often used—as in *gluteus maximus* and *gluteus minimus*.

Figure 2: A page illustrating the neuromuscular junction and skeletal muscle structure. This section provides detailed diagrams and activities for observing and studying muscle tissue.

4. CONTENT OVERVIEW

The manual covers a broad range of topics essential for an introductory anatomy and physiology course. Exercises are structured to provide hands-on experience and reinforce theoretical knowledge. Key areas include:

- Microscopic Anatomy (Histology)
- Skeletal System and Articulations
- Muscular System
- Nervous System and Special Senses
- Endocrine System
- Cardiovascular System
- Lymphatic and Immune Systems
- Respiratory System
- Digestive System

- Urinary System
- Reproductive System

Each topic includes practical activities, identification tasks, and critical thinking questions.

5. SPECIFICATIONS

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6. AUTHOR INFORMATION

The manual is authored by **Elaine N. Marieb**. Dr. Marieb is recognized for her student-centric teaching approach, developed through her extensive career teaching anatomy and physiology. Her background includes a Ph.D. in zoology and a Master of Science degree with a clinical specialization in gerontology, which informs the unique perspective and accessibility of her educational materials.

Dr. Marieb has contributed significantly to science education, including establishing scholarships and funding research laboratories. She is an active member of professional societies such as the Human Anatomy and Physiology Society (HAPS) and the American Association for the Advancement of Science (AAAS).

7. SUPPORT AND INQUIRIES

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