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Preface

Anatomy and Physiology of Speech and Hearing serves an important need in the training of students in the field of communication sciences and disorders. The Council for Clinical Certification in Audiology and Speech-Language Pathology (CFCC) is a semi-autonomous credentialing body of the American-Speech-Language-Hearing Association. The CFCC establishes standards for obtaining the Certificate of Clinical Competence (CCC) in Audiology and Speech-Language Pathology. CFCC certification standards require that applicants for the CCC have knowledge of the biological and physical sciences. This includes biology, human anatomy and physiology, neuroanatomy, neurophysiology, human genetics, physics, and chemistry. Students should also have knowledge of basic human communication and swallowing, including the underlying biological, neurological, and developmental bases of speech, language, swallowing, hearing and balance disorders. *Anatomy and Physiology of Speech and Hearing* is the most contemporary title on the market, unrivaled in its coverage of anatomy and physiology, including recent advances in the understanding of basic cell functions, biological control systems, and coordinated body functions.

Careful attention is given to detail and in the consistency and presentation of information throughout the title to maximize learning. *Anatomy and Physiology of Speech and Hearing* contains expertly written chapters that make anatomical and physiological concepts readily accessible to even the novice reader. Illustrations are beautifully prepared, and each contributor ensures that the subject matter is accessible, straightforward, and easy to understand. This book incorporates the latest developments in the biological underpinnings of respiration, phonation, articulation, hearing, swallowing, and balance function and dismisses many common misconceptions that have permeated the field of communication sciences and disorders over the years, replacing them with the most accurate and contemporary account available in the literature. This book sets the standard for what future titles that teach communication sciences and disorders students will look like.

FEATURES: The following features make the content of each chapter readily accessible to students.

1. Detailed and modern anatomical drawings in a style that students have enthusiastically endorsed. A few examples are shown below.
2. Recent developments in cellular biology and physiology; providing a contemporary understanding of the biological foundations of speech, language, swallowing, hearing and balance, and new concepts that are not found in any other title available on the market.
3. In all chapters, textboxes and sidebars are used to provide meaningful examples of clinical disorders and a context for applying newly learned concepts. This connection between basic and clinical science provides students with additional opportunities to maximize learning and apply this new knowledge in clinical practicum settings.
4. Didactic features to assist educators and students in consolidation of learning, including learning objectives at the start of every chapter, the highlighting of key terms and concepts throughout the book, review questions, and chapter ending summaries.
5. Online access to illustrations for use in presentations and lecture notes.
6. Online access to review questions and answers for interactive study and review.

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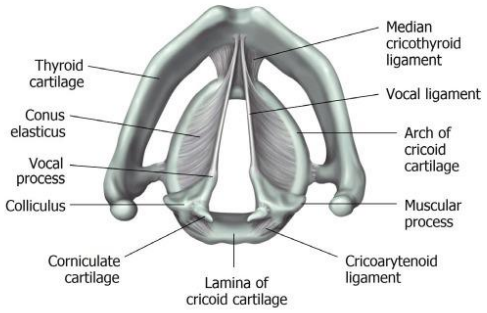
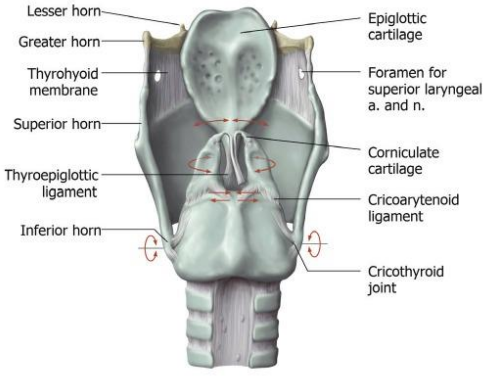


Structures of larynx (superior view)



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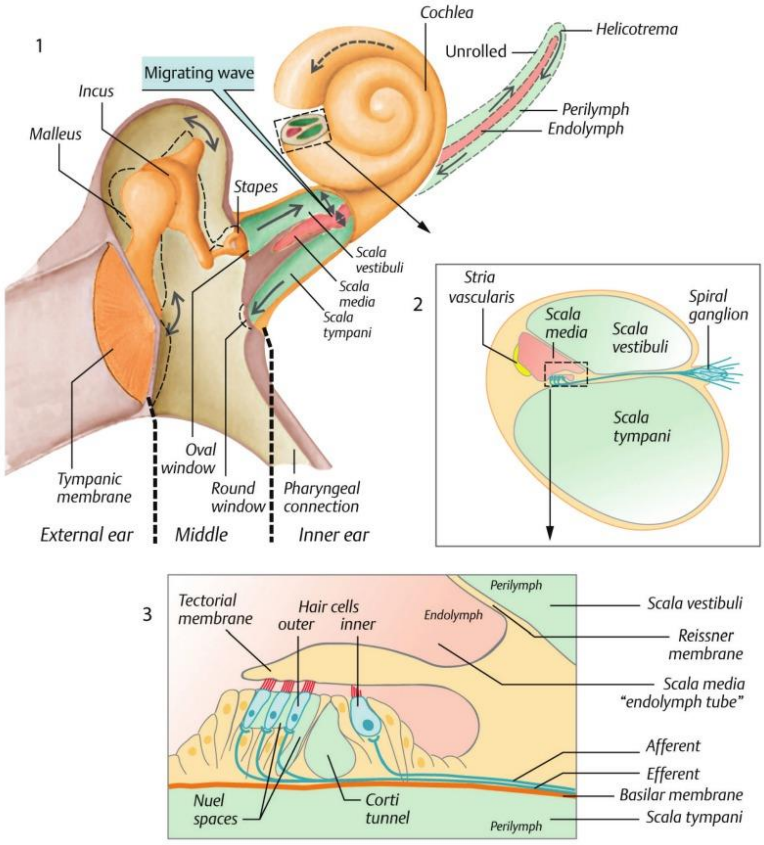
1
Migrating wave
Incus
Malleus
Stapes
Cochlea
Unrolled
Helicotrema
Perilymph
Endolymph
Scala vestibuli
Scala media
Scala tympani
Oval window
Round window
Pharyngeal connection
Tympanic membrane
External ear
Middle
Inner ear
2
Stria vascularis
Scala media
Scala vestibuli
Spiral ganglion
Scala tympani
3
Tectorial membrane
Hair cells
outer
inner
Endolymph
Perilymph
Scala vestibuli
Reissner membrane
Scala media
"endolymph tube"
Afferent
Efferent
Basilar membrane
Scala tympani
Nuel spaces
Corti tunnel
Perilymph

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Framework for Anatomy and Physiology

Samuel R. Atcherson, Melanie L. Meeker, and Bonnie K. Slavych

Chapter Summary

The human body is undeniably complex, yet it works in ways that can be understood in functional "bite-size" units, from micro (biochemical and cellular) to macro (system and body) levels. The study of anatomy and physiology is essential to the understanding of the human body. To fully appreciate a disorder, speech-language pathologists and audiologists must have a working knowledge of how various parts of the body function and how they work together toward a meaningful goal. The purpose of this chapter is to set the stage for the study of anatomy and physiology for speech, language, swallowing, hearing, balance, and related disorders. Specifically, we introduce terminology commonly used in the study of anatomy and physiology; provide an overview of the various body systems, including those used for speech, language, swallowing, hearing, balance, and related functions; and relate these concepts to disorders managed by speech-language pathologists and audiologists.

Learning Objectives

- Define and differentiate common terms used in the study of anatomy and physiology
- Understand the functions of the basic tissue and joint types in the human body
- Describe the general functions of the body systems supporting speech, language, swallowing, hearing, balance, and related functions

Putting It Into Practice

- Speech-language pathologists and audiologists are the professionals involved in the treatment of speech, language, swallowing, hearing, balance, and related disorders.
- The assessment and management of disorders related to speech, language, swallowing, hearing, and balance require a basic understanding of normal structure and function.
- The study of anatomy and physiology provides an essential framework in the practice of speech-language pathology and audiology.

Introduction

The study of human anatomy and physiology provides an important foundation for the speech-language pathologist and audiologist. The basic concepts of anatomy and physiology serve as the essential framework upon which to build an understanding of a variety of human activities. Students approaching the study of anatomy and physiology for the first time are often overwhelmed by the new terminology. Students will encounter many prefixes and suffixes that are used throughout the practice of medicine and related healthcare fields. Many of these roots are Latin or Greek in origin. For example, the prefix "a-" or "an-" is from a Greek word meaning "not" or "without." You may have encountered this prefix in the words *atypical* (meaning *not typical*) or *anaerobic* (meaning *with-*

out oxygen). An understanding of prefixes and suffixes will facilitate your learning of the material and increase the relevance of these terms to the practice of speech-language pathology and audiology.

A strong foundation in anatomy also provides important information about how the body works. Take the stylohyoid muscle as an example. Its name can be broken down into its component parts: *stylo-* (referencing the styloid process of the temporal bone) and *hyoid* (referencing the **U**-shaped bone above the larynx). The stylohyoid muscle spans the distance between the two structures. Knowing that striated skeletal muscles contract when stimulated, you can deduce that stimulation of this muscle draws the hyoid bone closer to the styloid process. An understanding of where the structures are located then provides information about function, which is to move the hyoid backward (posteriorly) toward the styloid. Although some exceptions to this general rule exist, a basic understanding of the general principles that underlie physiological function will provide a solid foundation upon which to build a conceptual framework.

To facilitate learning, students are encouraged to read assigned materials prior to class and to make purposeful notes in the margins of this text or on study cards. This preparation will allow you to more fully engage in lectures and acquire a deeper understanding of the concepts discussed during class. Consider incorporating a variety of cognitive and physical modalities in your learning. Practice drawing and labeling structures or manipulating them mentally to visualize them from different angles. Recite unfamiliar words aloud and practice their pronunciation. Explore topics of interest by accessing the supplemental materials referenced at the end of each chapter. Use the study questions at the end of each chapter to prepare for exams. These techniques will actively involve and engage aspects of your working memory and help you to organize and store information in your long-term memory for later retrieval (e.g., on an exam or when working with a patient). Mnemonic memory aids (e.g., acronyms or clever phrases) may also be helpful.

This text utilizes a variety of techniques to teach students keys to anatomical exploration and related physiology. The major anatomical systems are presented to familiarize students with the entire body. Glossary terms are bolded throughout the text, and definitions can be found within each chapter and at the end of the book. In addition, each chapter includes clinically relevant text boxes to increase the relevance of key concepts to clinical practice. Finally, a list of suggested readings in each chapter will guide the interested student to more information on the topics in the chapter.

Now that we have set the stage for your exploration of anatomy and physiology, let's begin. Simply stated, **anatomy** is the study of the structure of an organism. Gross anatomy consists of what can be inspected with the naked eye, such as what might occur in a cadaver lab. **Physiology** explores the functions of structures in a living organism. Together, the study of anatomy and physiology explores the structure and function of a living organism in terms of its parts and the organism as a whole. **Pathology** is the study of diseases and the structural and functional changes that affect an organism. This text provides a solid foundation in anatomy and physiology relevant to the practice of speech-language pathology and audiology.

Basic Elements of Anatomy

General Anatomical Terms and Anatomical Position

Early anatomists named structures based on what they resembled. As an example, a structure deep within the brain has a curly shape that, upon discovery, was thought to resemble a seahorse, so it was named the hippocampus from the Greek word for that animal. Hippos, "horse," is also found in hippotherapy, which makes use of the rhythmic movements of the horse.

Once you learn to deconstruct the vocabulary of anatomy, you will be on your way to mastery of the material. **Table 1.1** provides roots, their meanings, and an example of each root in the context of some commonly used terms in speech-language pathology and audiology.

Terms of Orientation

Used as a reference to describe various body parts relative to one another, the standard posture when in the anatomic position is with your full body standing straight, with the face directed forward, the arms hanging down at your sides with your palms facing forward, fingers pointing straight down, and the knees facing forward with the feet slightly apart and pointed forward. Anatomic position is important as it is the assumed position of reference when using directional terms to describe position or direction of body structures. Anatomic position is shown in **Fig. 1.1**.

Just as the directional terms north, east, south, and west serve as a reference on a compass (or GPS system), directional terms are commonly used to