

# ANATOMY & PHYSIOLOGY

for Speech, Language, and Hearing



FOURTH EDITION

J. Anthony Seikel  
Douglas W. King  
David G. Drumright

# **ANATOMY & PHYSIOLOGY**

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FOURTH EDITION

J. Anthony Seikel, Ph.D., Idaho State University  
Douglas W. King, Ph. D.  
David G. Drumright, Computer Programmer

Photography by Sarah Moore and Susan Duncan



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**Anatomy & Physiology for Speech,  
Language, and Hearing, 4<sup>th</sup> edition**

J. Anthony Seikel, Ph.D.,  
Douglas W. King, Ph.D.,  
David G. Drumright

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Library of Congress Control Number: 2009924509

ISBN-13: 978-1-4283-1223-4

ISBN-10: 1-4283-1223-4

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## **DEDICATION**

*We wish to dedicate this revision to the memory of our co-author, Douglas King  
(JAS & DD)*

*The programmer (DD) dedicates this software to Professor Merle Phillips,  
who taught him something about audiology and a lot about life.  
The narrative author (JAS) wishes to dedicate the text to speech-language  
pathologists, audiologists, and learners in training for their  
dedication to the betterment of the lives of their clients.  
You represent that which is the best of society.*

---

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# Contents

Preface to the Fourth Edition	xv
Acknowledgments	xix
Introduction to the Learner	xxi
Using This Text	xxiii
How to Use Studyware™	xxvii
Overview of the Text	xxx

## **Chapter 1** Basic Elements of Anatomy **1**

---

Anatomy and Physiology	1
Terminology of Anatomy	4
Parts of the Body	4
Terms of Orientation	4
Building Blocks of Anatomy: Organs, Tissues, and Systems	10
Organs	10
Tissues	11
Body Systems	26
Chapter Summary	28
Study Questions	29
Study Question Answers	31
References	33

## **Chapter 2** Anatomy of Respiration **35**

---

The Support Structure of Respiration	38
Overview	38
Vertebral Column	39
Pelvic and Pectoral Girdles	49
Ribs and Rib Cage	55
Soft Tissue of the Thorax and Respiratory Passageway	60
Movement of Air Through the System	75
Muscles of Inspiration	79
Primary Inspiratory Muscle of Thorax	80
Accessory Muscles of Inspiration	86



Muscles of Forced Expiration 106  
    Muscles of Thorax: Anterior/Lateral Thoracic Muscles 108  
    Abdominal Muscles of Expiration 112  
Chapter Summary 119  
Study Questions 119  
Study Question Answers 126  
References 128

---

**Chapter 3 Physiology of Respiration 131**

---

The Measurement of Respiration 133  
Respiration for Life 134  
    Effects of Turbulence on Respiration 135  
    Respiratory Cycle 135  
    Developmental Processes in Respiration 136  
Volumes and Capacities 138  
    Volumes 140  
    Capacities 142  
    Effect of Age on Volumes 143  
Pressures of the Respiratory System 145  
    Pressures Generated by the Tissue 152  
Effects of Posture on Speech 155  
Pressures of Speech 157  
Chapter Summary 160  
Study Questions 161  
Study Question Answers 162  
References 162

---

**Chapter 4 Anatomy of Phonation 165**

---

A Tour of the Phonatory Mechanism 166  
    Framework of the Larynx 166  
    Cavities of the Larynx 174  
    Structure of the Larynx 179  
Laryngeal Musculature 187  
    Intrinsic Laryngeal Muscles 189  
    Laryngeal Elevators and Depressors 200  
    Interaction of Musculature 211  
Chapter Summary 211  
Study Questions 213  
Study Question Answers 219  
References 220

**Chapter 5 Physiology of Phonation 223**

---

- Nonspeech Laryngeal Function 223
- Laryngeal Function for Speech 227
  - The Bernoulli Effect 227
  - Attack 232
  - Termination 233
  - Sustained Phonation 234
  - Vocal Register 235
  - Frequency, Pitch, and Pitch Change 243
  - Intensity and Intensity Change 249
- Clinical Considerations 253
- Linguistic Aspects of Pitch and Intensity 254
- Theories of Phonation 256
- Chapter Summary 258
- End Note: Mechanics of Vibration 259
- Study Questions 261
- Study Question Answers 262
- References 263

**Chapter 6 Anatomy of Articulation and Resonation 267**

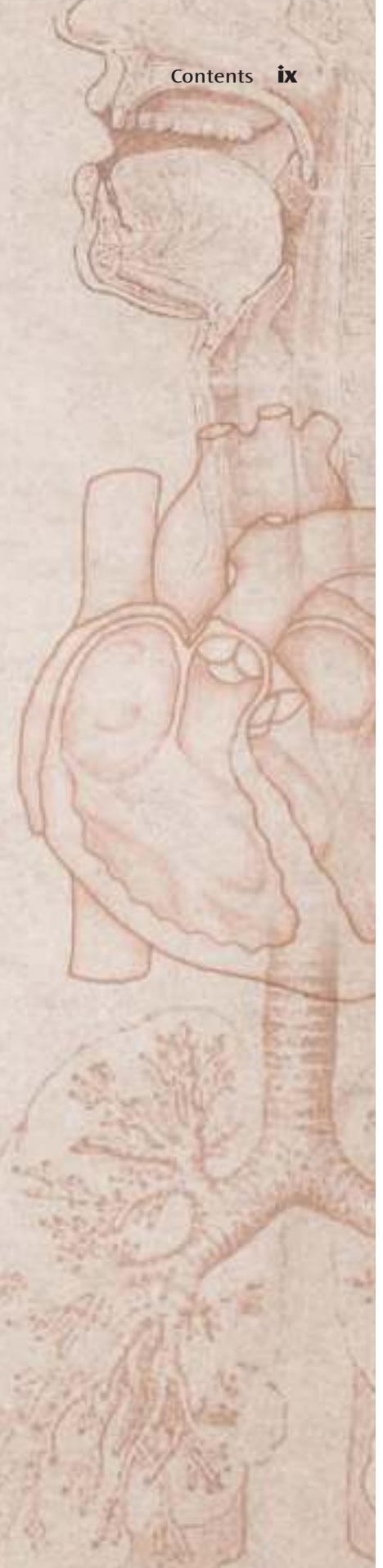
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- Source-Filter Theory of Vowel Production 267
- The Articulators 271
- Bones of the Face and Cranial Skeleton 283
  - Bones of the Face 283
  - Bones of the Cranial Skeleton 298
- Dentition 307
  - Dental Development 313
  - Dental Occlusion 316
- Cavities of the Vocal Tract 320
- Muscles of the Face and Mouth 327
  - Muscles of the Face 327
  - Muscles of the Mouth 336
- Chapter Summary 361
- Study Questions 363
- Study Question Answers 372
- References 374

**Chapter 7 Physiology of Articulation and Resonation 377**

---

- Speech Function 377
  - Lips 378
  - Mandible 379



Tongue 380  
Velum 383  
Development of Articulatory Ability 384  
Development of the Vocal Tract 387  
Coordinated Articulation 390  
The DIVA Model of Speech Production 394  
Chapter Summary 398  
Study Questions 399  
Study Question Answers 400  
References 401

## **Chapter 8** Physiology of Mastication and Deglutition **405**

---

Biological Function 405  
    Introduction to Mastication and Deglutition 405  
    Anatomical and Physiological Developmental Issues 406  
Organizational Patterns of Mastication and Deglutition 409  
    Oral Preparatory Stage (Mastication) 410  
    Oral Stage 412  
    Pharyngeal Stage 413  
    Esophageal Phase 417  
    Pressures of Deglutition 417  
Neurophysiological Underpinnings of Mastication  
and Deglutition 418  
    Sensation Associated with Mastication  
    and Deglutition 418  
    Salivation Response 429  
Reflexive Circuits of Mastication and Deglutition 431  
    Chewing Reflex 433  
    Rooting and Sucking Reflexes 433  
    Uvular (Palatal) Reflex 433  
    Gag (Pharyngeal) Reflex 434  
    Retch and Vomit Reflex 434  
    Cough Reflex 434  
    Tongue Base Retraction and Elevation 435  
    Pain Reflex 435  
    Respiration Reflexes 435  
Reexamination of the Patterns for Mastication  
and Deglutition 436  
Chapter Summary 437  
Study Questions 439  
Study Question Answers 441  
References 443

**Chapter 9 Anatomy of Hearing 447**

---

- The Structures of Hearing 447
- Outer Ear 448
- Middle Ear 453
  - Ossicles 453
  - Tympanic Muscles 456
  - Landmarks of the Middle Ear 458
- Inner Ear 461
  - Osseous Vestibule 461
  - Osseous Semicircular Canals 464
  - Osseous Cochlear Labyrinth 465
  - Membranous Labyrinth 467
- Chapter Summary 473
- Study Questions 475
- Study Question Answers 476
- References 477

**Chapter 10 Auditory Physiology 479**

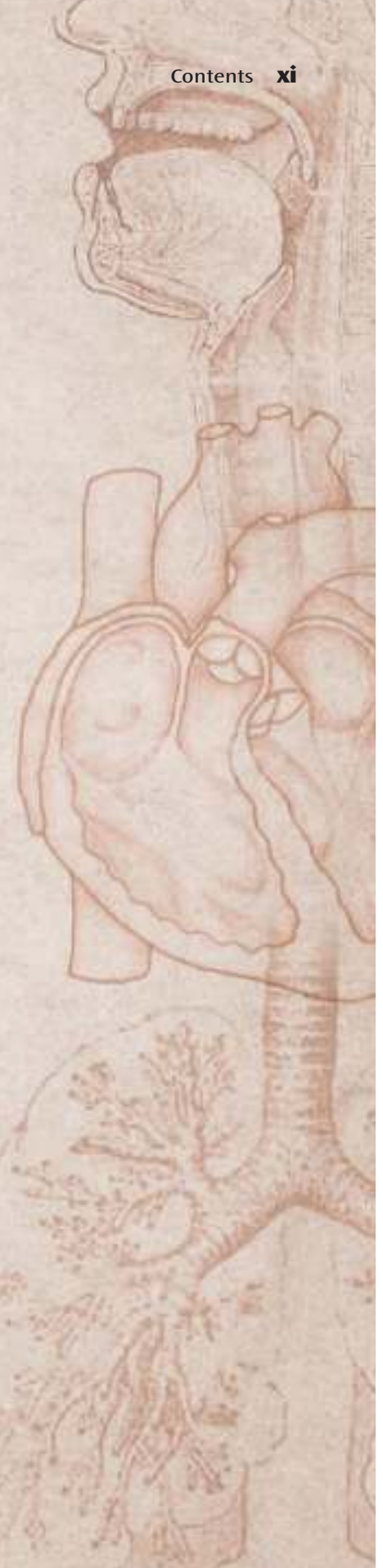
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- Outer Ear 480
- Middle Ear Function 481
- Inner Ear Function 482
  - Vestibular Mechanism 482
  - Auditory Mechanism: Mechanical Events 482
  - Electrical Events 487
  - Resting Potentials 489
  - Neural Responses 491
  - Auditory Pathway Responses 499
- Chapter Summary 514
- Study Questions 516
- Study Question Answers 517
- References 518

**Chapter 11 Neuroanatomy 521**

---

- Overview 521
- Divisions of the Nervous System 527
  - Central Nervous System/Peripheral Nervous System 527
  - Autonomic/Somatic Nervous Systems 528
  - Development Divisions 529
- Anatomy of the CNS and PNS 531
  - Neurons 531



Anatomy of the Cerebrum	540
Meningeal Linings	540
The Ventricles and Cerebrospinal Fluid	546
Anatomy of the Brainstem	582
Cranial Nerves	594
Specific Cranial Nerves	595
Anatomy of the Spinal Cord	616
Chapter Summary	633
Study Questions	636
Study Question Answers	641
References	643

---

**Chapter 12 Neurophysiology** **647**

---

The Neuron	648
Neuron Function	648
Muscle Function	657
Muscle Spindle Function	662
Golgi Tendon Organs	667
Other Sensation and Sensors	668
Higher Functioning	669
Motor System Lesions	674
Afferent Inputs	678
Association Regions	678
Hemispheric Specialization	681
Lesion Studies	683
Motor Control for Speech	692
Chapter Summary	694
Study Questions	696
Study Question Answers	697
References	698

---

**Appendix A Anatomical Terms** **701**

---

**Appendix B Useful Combining Forms** **703**

---

**Appendix C Muscles of Respiration** **707**

---

Thoracic Muscles of Inspiration	707
Abdominal Muscles of Expiration	713
Muscles of Upper Limb	714

**Appendix D Muscles of Phonation 715**

---

- Intrinsic Laryngeal Muscles 715
- Extrinsic Laryngeal, Infrahyoid, and Suprahyoid Muscles 716

**Appendix E Muscles of Face, Soft Palate, and Pharynx 719**

---

- Facial Muscles 719
- Muscles of the Velum 724
- Muscles of Pharynx 725

**Appendix F Sensors 727**

---

- General Classes 727
- Specific Types 727
- Classes of Sensation 727

**Appendix G Cranial Nerves 729**

---

- Classes of Cranial Nerves 729
- Cranial Nerves, Sources, and Functions 729

**Appendix H Pathologies That Affect Speech Production 733**

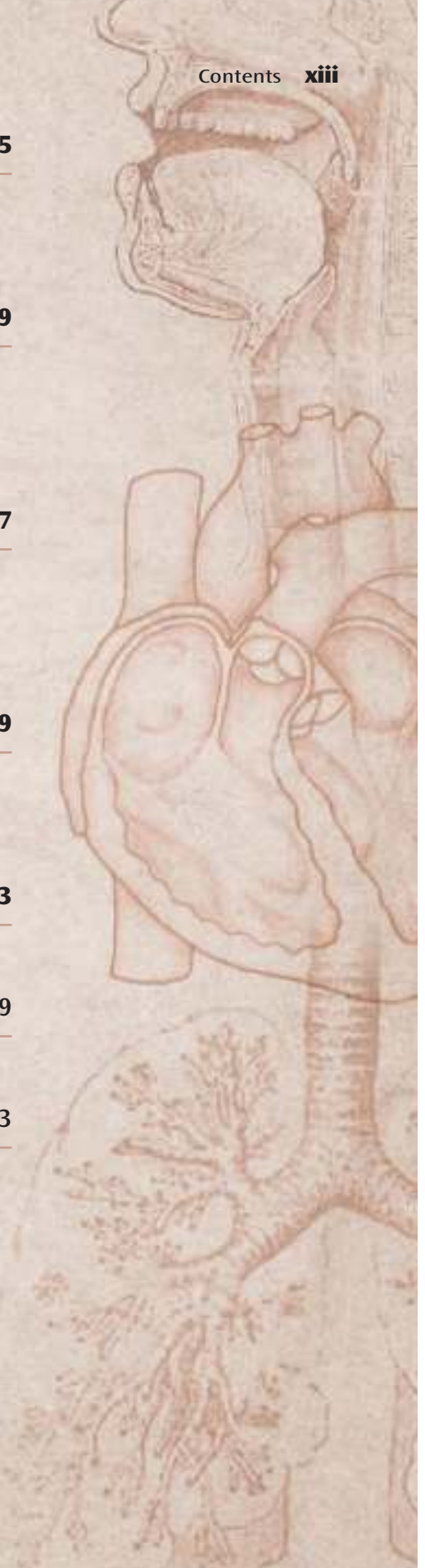
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**Glossary 739**

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**Index 763**

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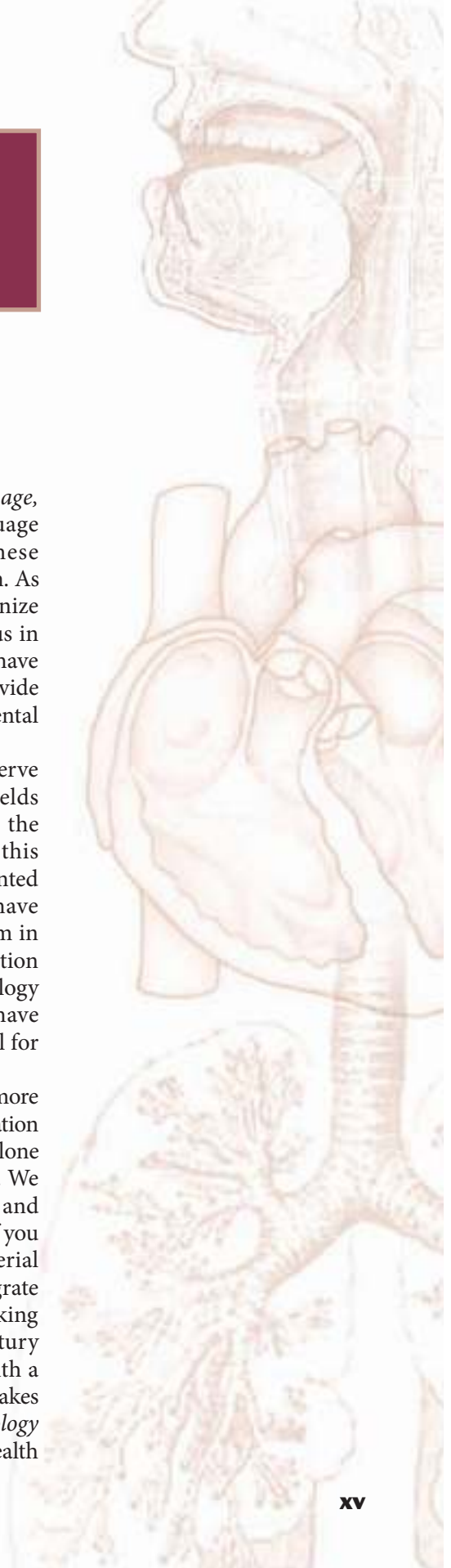
# Preface to the Fourth Edition

## Introduction

This fourth edition of *Anatomy & Physiology for Speech, Language, and Hearing* reflects the ever-changing nature of speech-language pathology and audiology. We recognize that students in these disciplines are required to be masters of a great deal of information. As speech-language pathologists and audiologists, we not only recognize the great debt that we owe to those who have blazed a trail for us in the profession, but also recognize the awesome responsibility we have toward those within our care. In this text, we have attempted to provide you, the student, with foundational information in this developmental stage of your careers.

This text and its ancillary materials have been designed to serve the upper division undergraduate or graduate student in the fields of speech-language pathology and audiology. We desire to keep the information current and applicable to your future needs, and this desire has led to numerous changes for the fourth edition. We wanted the information to be presented as clearly as possible, so we have significantly redrawn many of the figures and have provided them in color. We have significantly updated the articulation physiology section and have added a great deal of relevant detail to the hearing physiology section, reflecting exciting new discoveries in these areas. We have updated the ANATESSE software, which is an excellent study tool for students. We are very excited about these revisions.

We, the authors of this text, are committed to making learning more than a process of rote memorization. We realize that there *is* memorization involved in the study of anatomy and physiology, but memorization alone will not prepare you to work with your challenging future clients. We are convinced that we learn most what we are able to experience and that learning is not a spectator sport. As instructors, we know that if you are able to manipulate the material under study or view the material using different sensory modalities, you will better be able to integrate that material into your knowledge base. We are committed to making the text and its ancillary materials as useful to twenty-first-century students as possible. This revision not only provides students with a great interactive study tool in the ANATESSE CD-ROM but also makes available the *Instructor Resources to Accompany Anatomy & Physiology of Speech, Language, and Hearing, 4th Edition*, which provides a wealth of instructor resources to facilitate student learning.





## Organization of Anatomy and Physiology for Speech, Language, and Hearing

We continue to organize the text around the classical framework of systems of speech, language, and hearing. We separate out the anatomy and physiology components to facilitate learning. We introduce the student to the terminology of anatomy and physiology and bring those terms to life in the anatomy and physiology chapters of the respiratory system. We then investigate the phonatory system and then the anatomy and physiology of the articulatory/resonatory system. We have included a chapter on the physiology of swallowing as well, reflecting the vital importance of this function in the field of speech-language pathology. We follow this with the auditory system anatomy and physiology. We have greatly increased our discussion of hearing physiology, particularly at the level of the cerebral cortex, and this is reflected in both the hearing physiology and neurophysiology chapters. Anatomy and physiology of the nervous system make up the final chapters of the revised text.

## New to the Fourth Edition

With the fourth edition we have introduced full-color images (drawings and photographs) to enhance your ability to integrate the information. We have revised and updated the articulatory, auditory, and neurophysiology sections, and additional glossary terms appear in the margin to clarify information.

## How to Use This Text

This text provides a sequential tour of the anatomy and physiology associated with speech, language, and hearing. It was designed with today's students in mind and provides ancillary materials that greatly enhance learning. As you read the text, realize that you will be presented with the details of anatomy first and that it is very important to master them to make these details your own. Use the companion software to support the learning, and you will find that the quizzes and animations it provides will greatly reinforce your learning. We, as teachers of anatomy and physiology, have found that frequent quizzes really help a student learn the material. The software has these same frequent quizzes, and you will find that they will greatly enhance your understanding of the material. We want you to be the best therapist you can be and sincerely hope that these materials move you along the path of your chosen career.

## Instructor Supplements Accompanying the Fourth Edition

We continue to offer the *Instructor Resources to Accompany Anatomy & Physiology of Speech, Language, and Hearing, 4th Edition*. This set of materials provides the instructor with a searchable Image Library containing high-quality scans of all figures in the text for use

in individualized classroom presentations or testing. We have now included animations that illustrate the process of phonation, respiration, and the process of swallowing, among other processes. In addition, the *Instructor Resources* provides a downloadable and customizable *Instructor's Manual* containing a syllabus with materials and suggested activities for the lecture, and lab guides to facilitate learning outside of the classroom. The *Instructor Resources* offers a *Computerized Test Bank* with 1,000 plus questions and answers, for use in instructor-created quizzes and tests. Lastly, chapter slides created using PowerPoint® have been added to provide you with in-class lecture material and handouts for students. The most important feature of all the components in the *Instructor Resources* is that everything is customizable. Just as the syllabus can be downloaded and reworked to meet an individual's personal instructional goals, the instructor can pick and choose the questions in the *Computerized Test Bank* that best fit the needs of a particular course or group of students. This comprehensive package provides something for all instructors, from those teaching anatomy and physiology for the first time to seasoned instructors who want something new.

## Student Supplements Accompanying the Fourth Edition

In addition to the ANATESSE software provided with each edition, the fourth edition includes another type of student practice software called StudyWARE™ (see the section on “How To Use StudyWARE”, for more information). This software offers quizzes, learning activities, and animations to help the student practice topics on his own. This software is provided to the student as an additional resource to prepare for in-class examinations and quizzes. Coupled with ANATESSE, the student supplements of the fourth edition provide every type of learner with the materials necessary to succeed in an often-difficult subject area.

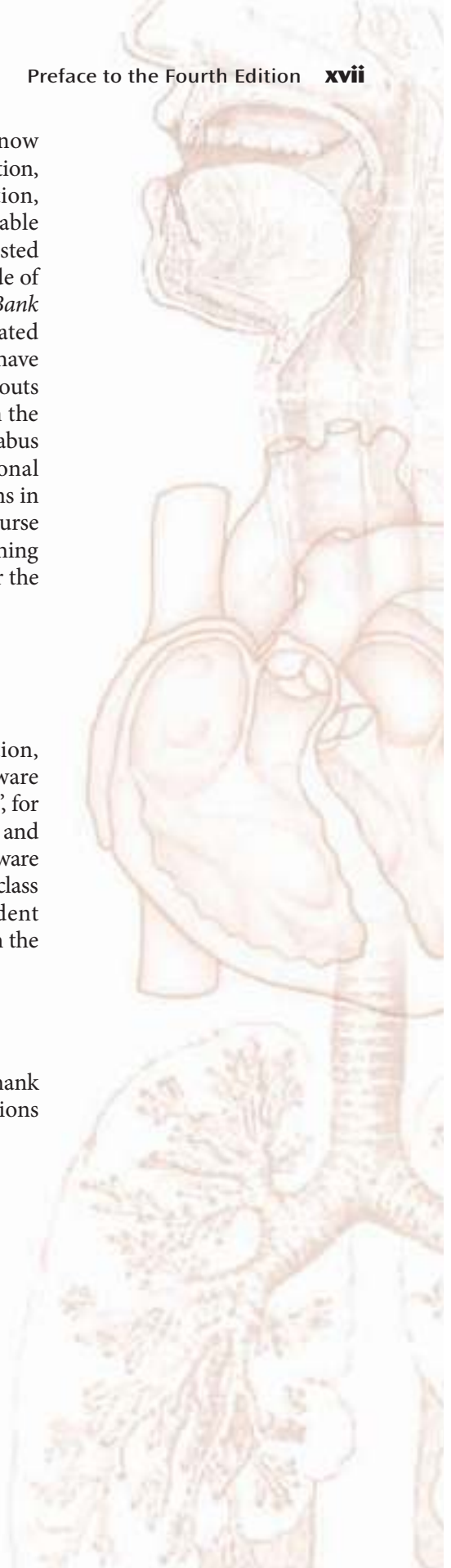
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On behalf of the authors, Delmar Cengage Learning would like to thank the following reviewers for their insightful comments and suggestions throughout the development process:

Alfredo Ardila, Ph.D., ABPN  
Professor, Department of Communication Sciences and Disorders  
Florida International University  
Miami, FL

Michael Blomgren, Ph.D., CCC-SLP  
Associate Professor, Department of Communication Sciences  
and Disorders  
The University of Utah  
Salt Lake City, UT

Stephanie S. Cotton, M.A., CCC-SLP  
Northern Arizona University  
Flagstaff, AZ



Ruby Drew, Ph.D.  
Board Certified in Neurologic Communication Disorders  
Associate Professor  
Western Carolina University  
Cullowhee, NC

Donald S. Finan, Ph.D.  
Assistant Professor, Department of Speech, Language,  
and Hearing Sciences  
University of Colorado at Boulder  
Boulder, CO

Gail B. Kempster, Ph.D., CCC-SLP  
Associate Professor, Department of Communication Disorders  
and Sciences  
Rush University  
Chicago, IL

Lisa LaSalle, Ph.D.  
Professor, Department of Communication Sciences and Disorders  
University of Wisconsin at Eau Claire  
Eau Claire, WI

Nancy Manasse, Ph.D.  
California State University, Los Angeles  
Los Angeles, CA

Bridget Russell, Ph.D., CCC-SLP  
Associate Professor, Department of Speech Pathology and Audiology  
State University of New York at Fredonia  
Fredonia, NY

## About the Authors

J. Anthony (Tony) Seikel is on faculty at Idaho State University in Pocatello, Idaho. His research interests center on the relationship of pathology with acoustics and perception, but extend as well to the improvement of pedagogy through technology.

Douglas W. King was a professor within the Basic Medical program at Washington State University until the time of his death in 2001. He was greatly loved by his students and fellow faculty and had set up a scholarship program in anatomy for students with diabetes.

David G. Drumright is a programmer and teacher in Spokane, Washington. He has taught electronics at numerous schools and has a background in speech-language pathology and audiology. His software includes the original ANIMA programs of this text; the ANATESSE application that you see in this fourth edition; AUDIN, which is software for instruction in audiology; and numerous smaller instructional tools.

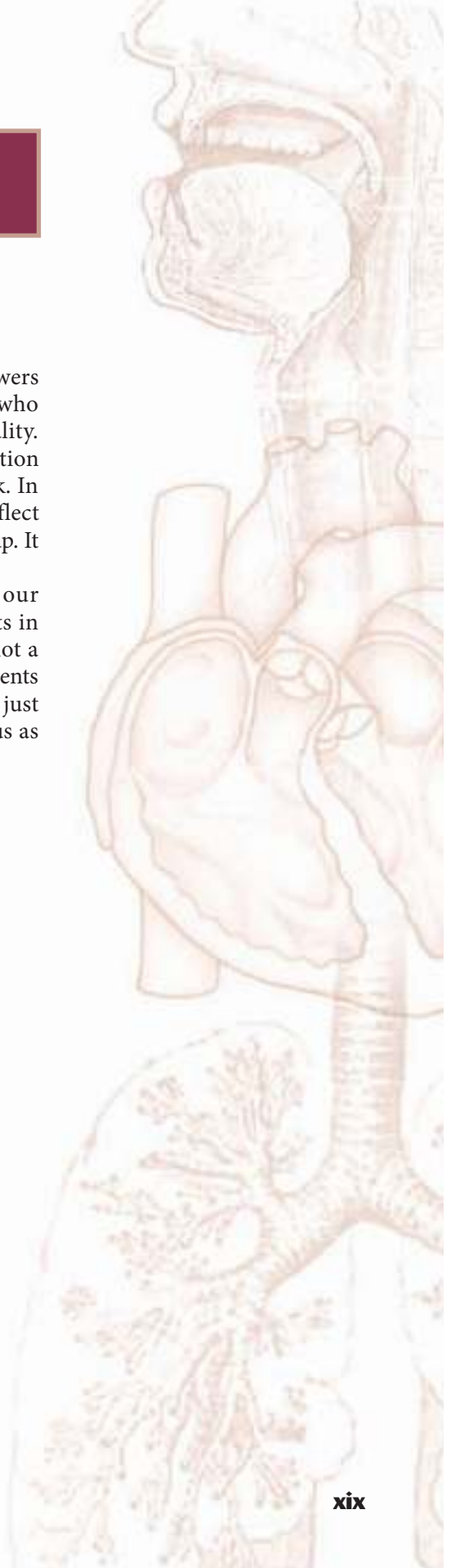
J. Anthony (Tony) Seikel  
David G. Drumright

# Acknowledgments

**W**e want to express our deepest appreciation to the reviewers and dedicated members of the Delmar Cengage team who were so instrumental in making this 4th edition a reality. We are awed by the effort that reviewers put into their examination of our material, and hope that we have done justice to their work. In the same vein, the changes made to the text with this revision reflect extraordinary efforts by the members of the Delmar Cengage group. It has been a pleasure to work with them on this project.

As authors, we must also acknowledge the source of our inspiration. We have been actively involved in teaching students in speech-language pathology and audiology for some time, and not a semester goes by that we don't realize how very dedicated our students are. There is something special about our fields that attracts not just the brightest, but the most compassionate. You, students, keep us as teachers alive and vital.

Thank you.



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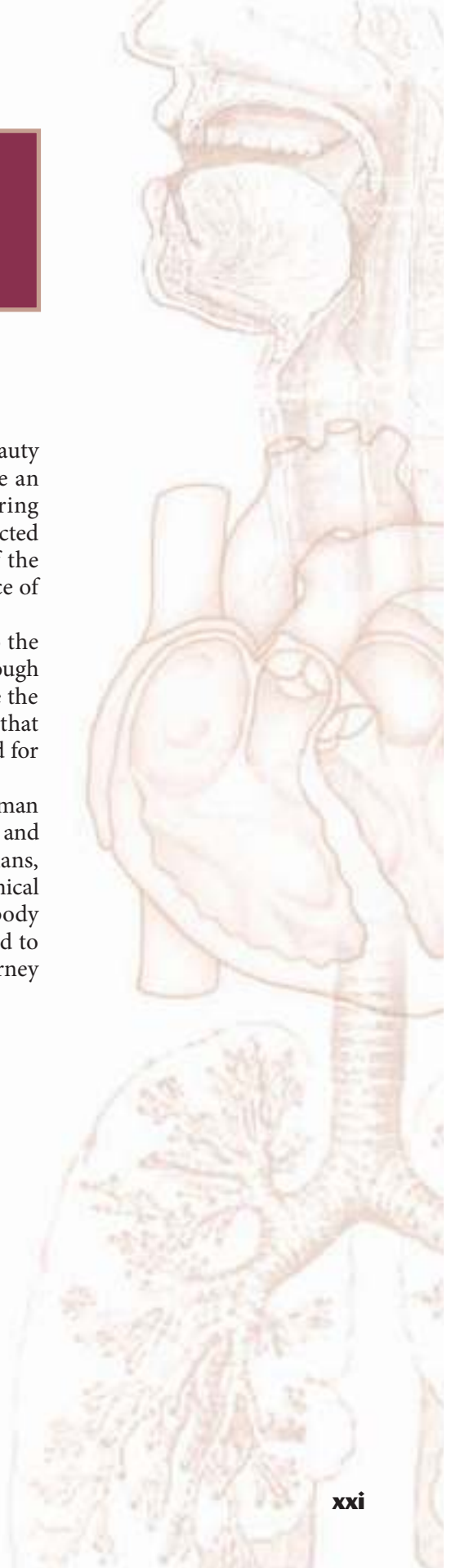
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# Introduction to the Learner

**W**e continue to be impressed with the complexity and beauty of the systems of human communication. Humans use an extremely complex system for communication, requiring extraordinary coordination and control of an intensely interconnected sensorimotor system. It is our heartfelt desire that the study of the physical system will lead you to an appreciation of the importance of your future work as a speech-language pathologist or audiologist.

We also know that the intensity of your study will work to the benefit of your future clients and that the knowledge you gain through your effort will be applied throughout your career. We appreciate the fact that the study of anatomy is difficult, but we also recognize that the effort you put forth now will provide you with the background for work with the medical community.

A deep understanding of the structure and function of the human body is critical to the individual who is charged with the diagnosis and treatment of speech and language disorders. As beginning clinicians, you are already aware of the awesome responsibility you bear in clinical management. It is our firm belief that knowledge of the human body and how it works will provide you with the background you need to make informed and wise decisions. We welcome you on your journey into the world of anatomy.



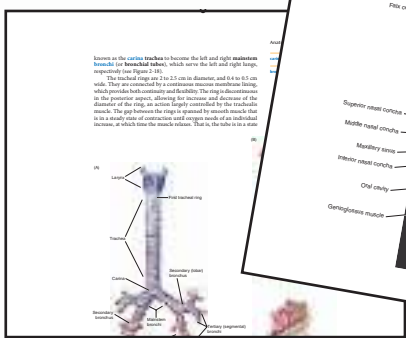
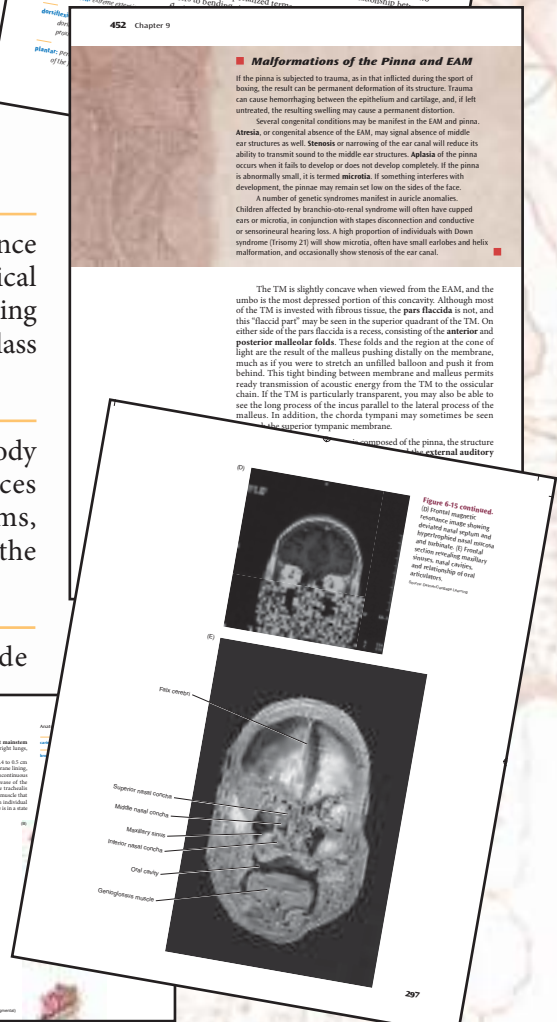
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# Using This Text

This text provides a sequential tour of the anatomy and physiology associated with speech, language, and hearing. It was designed with today's students in mind and provides ancillary materials that greatly enhance learning. As you read the text, realize that you will be presented with the details of anatomy first and that it is very important to master them to make these details your own. Use the elements found in the text to help guide you as you move along the path of your chosen career.

- **Margin notes** identify important terminology, root words, and definitions, which are highlighted in color throughout each chapter. Other important terms are boldfaced in text to indicate that a corresponding definition can be found in the Glossary. Use these terms to study and prepare for tests and quizzes.
- **Clinical Notes** relate a topic directly to clinical experience to emphasize the importance of anatomy in your clinical practice. Gain insight into your chosen profession by using the topics discussed for research papers, to facilitate in-class discussion, and to complete homework assignments.
- **Over 100 photographs** provide a real-life look at the body parts and functions you are studying. Use these pieces as reference for accuracy in describing body systems, parts, and processes. Allow yourself to be amazed by the intricacies of human anatomy!
- **Over 300 illustrations, graphs, and charts** provide visual examples of the anatomy, processes, and body systems discussed. Refer to the figures as you read the text to enhance your understanding of the specific idea or anatomical component being discussed. When reviewing for quizzes and tests, refer back to the figures for an important visual recap of the topics discussed.





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