

ANATOMY & PHYSIOLOGY

for Speech, Language, and Hearing



FOURTH EDITION

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

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FOURTH EDITION

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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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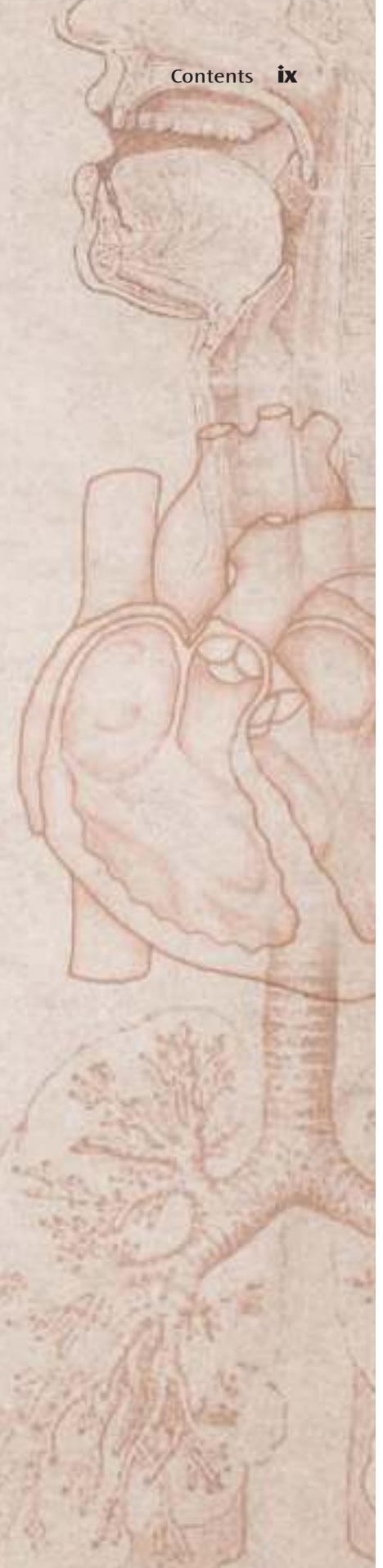
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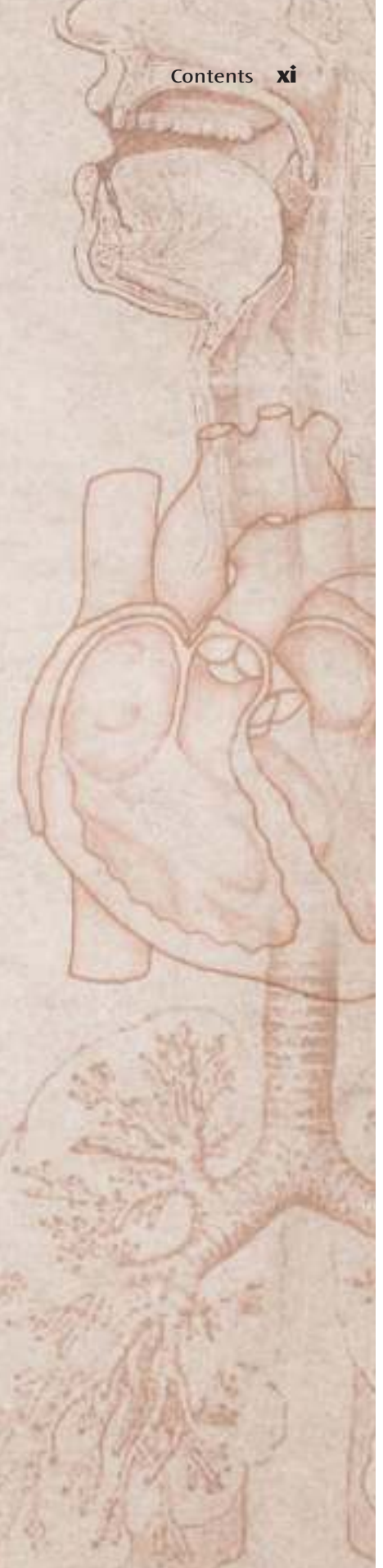
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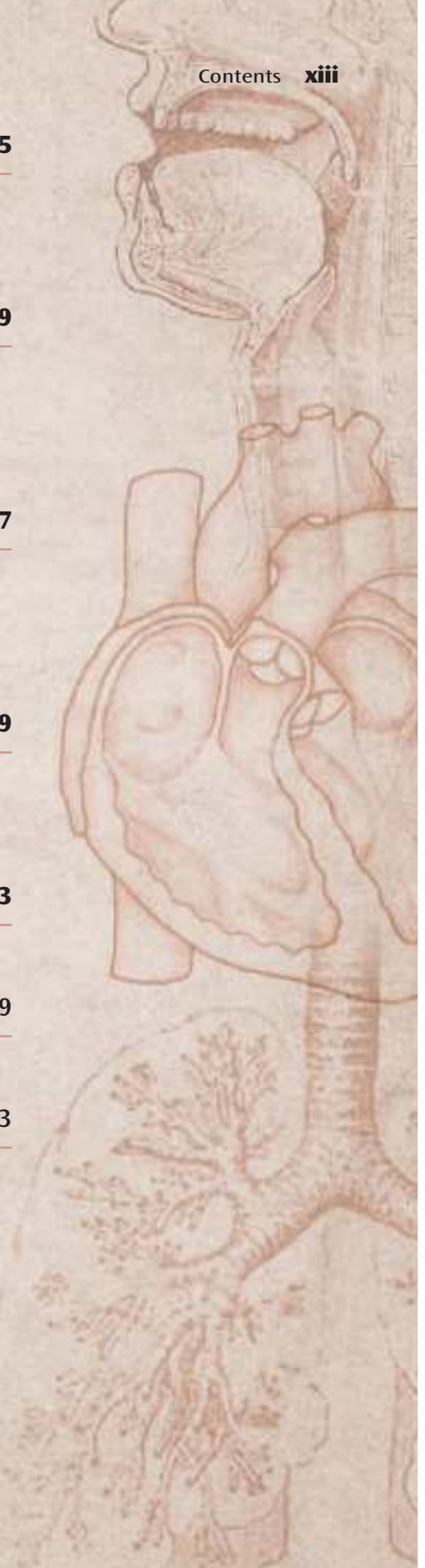
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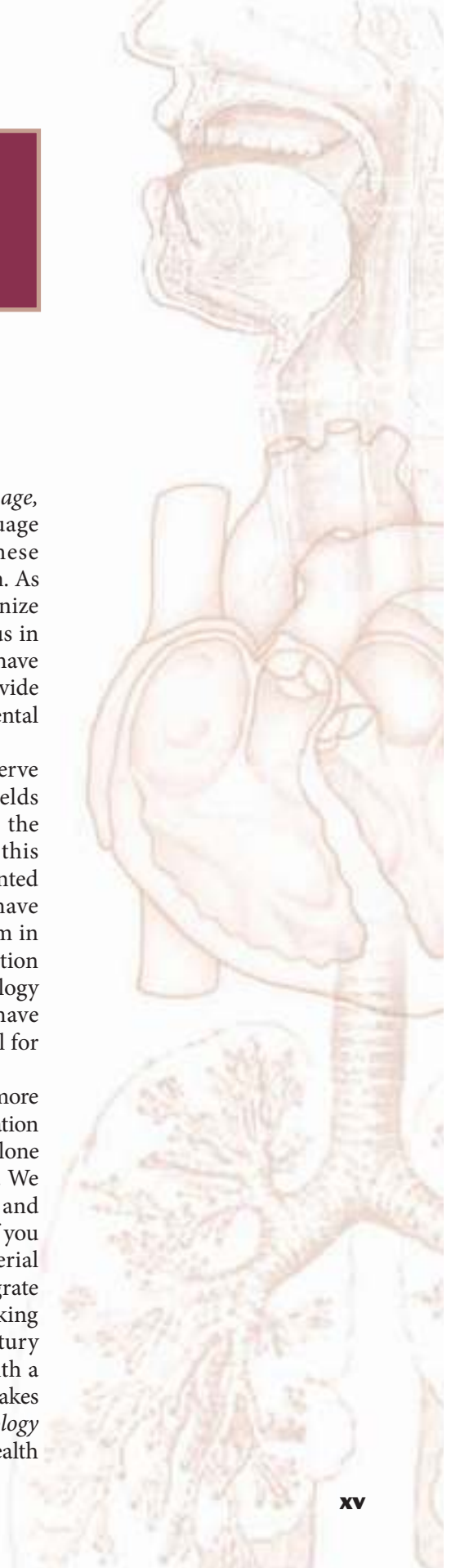
Preface to the Fourth Edition

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.

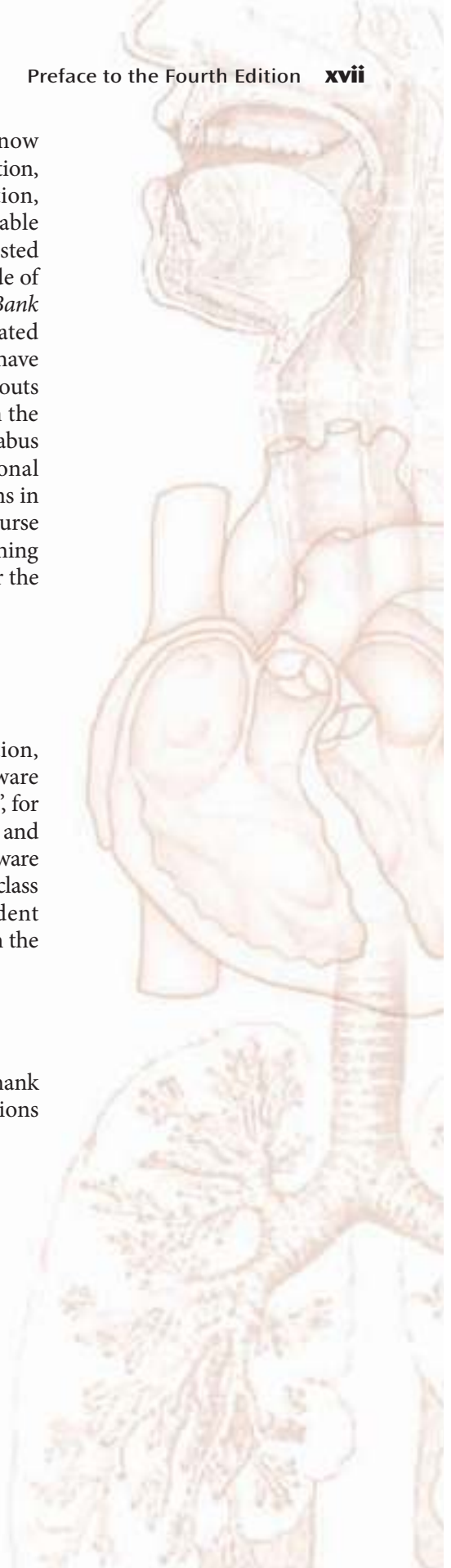
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On behalf of the authors, Delmar Cengage Learning would like to thank the following reviewers for their insightful comments and suggestions throughout the development process:

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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.

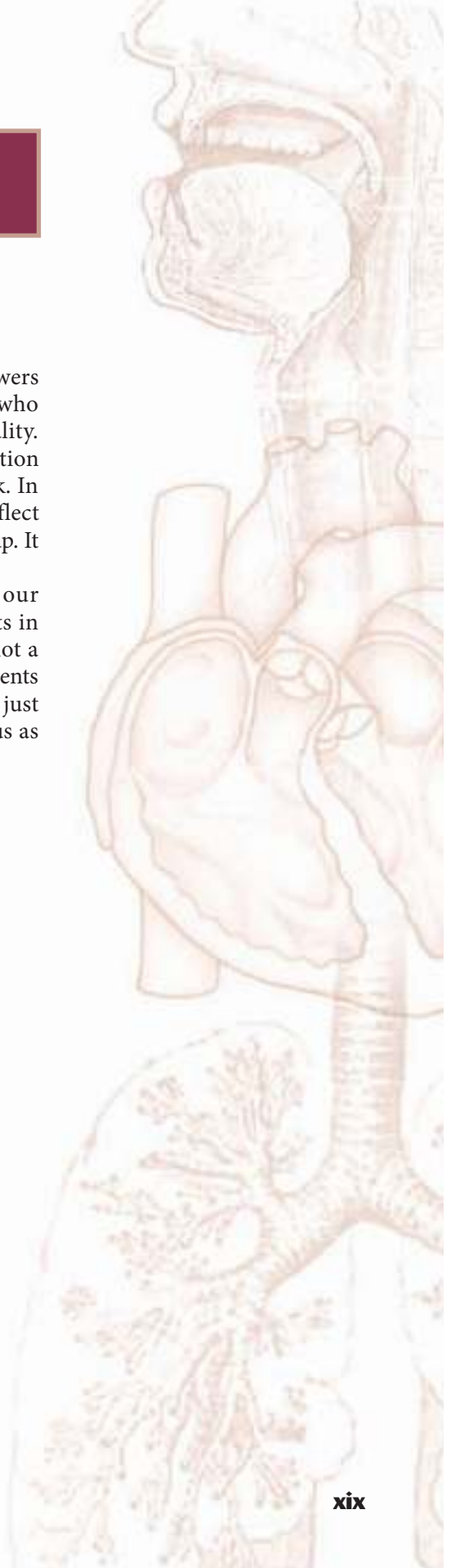
J. Anthony (Tony) Seikel
David G. Drumright

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We 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.



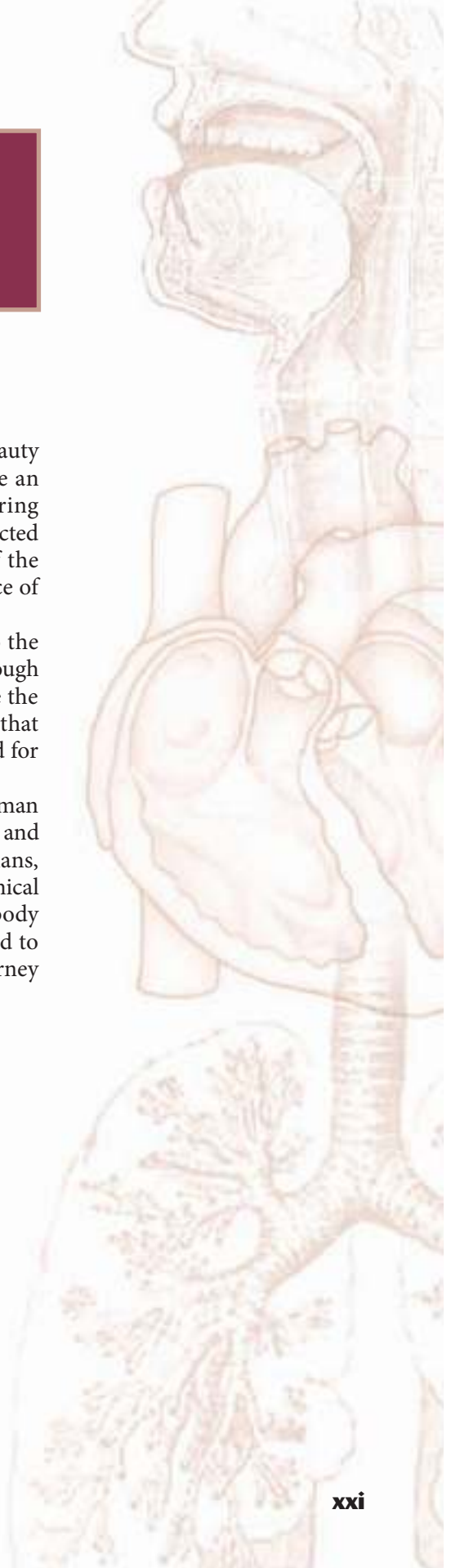
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Introduction to the Learner

We 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.

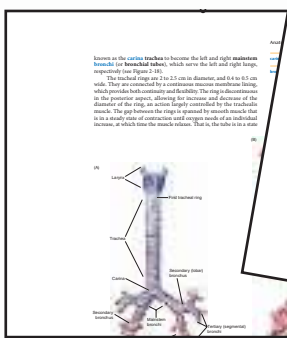
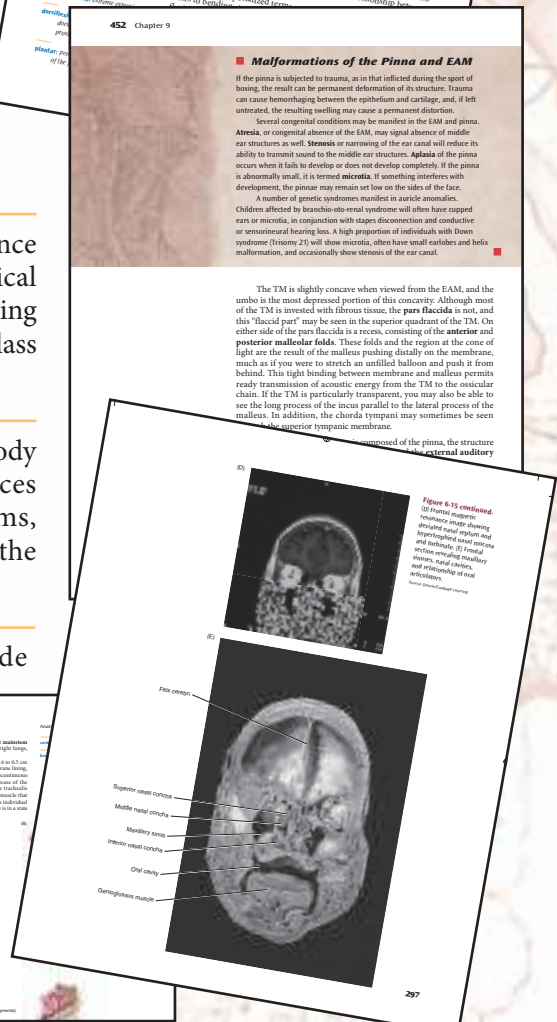


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Using This Text

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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