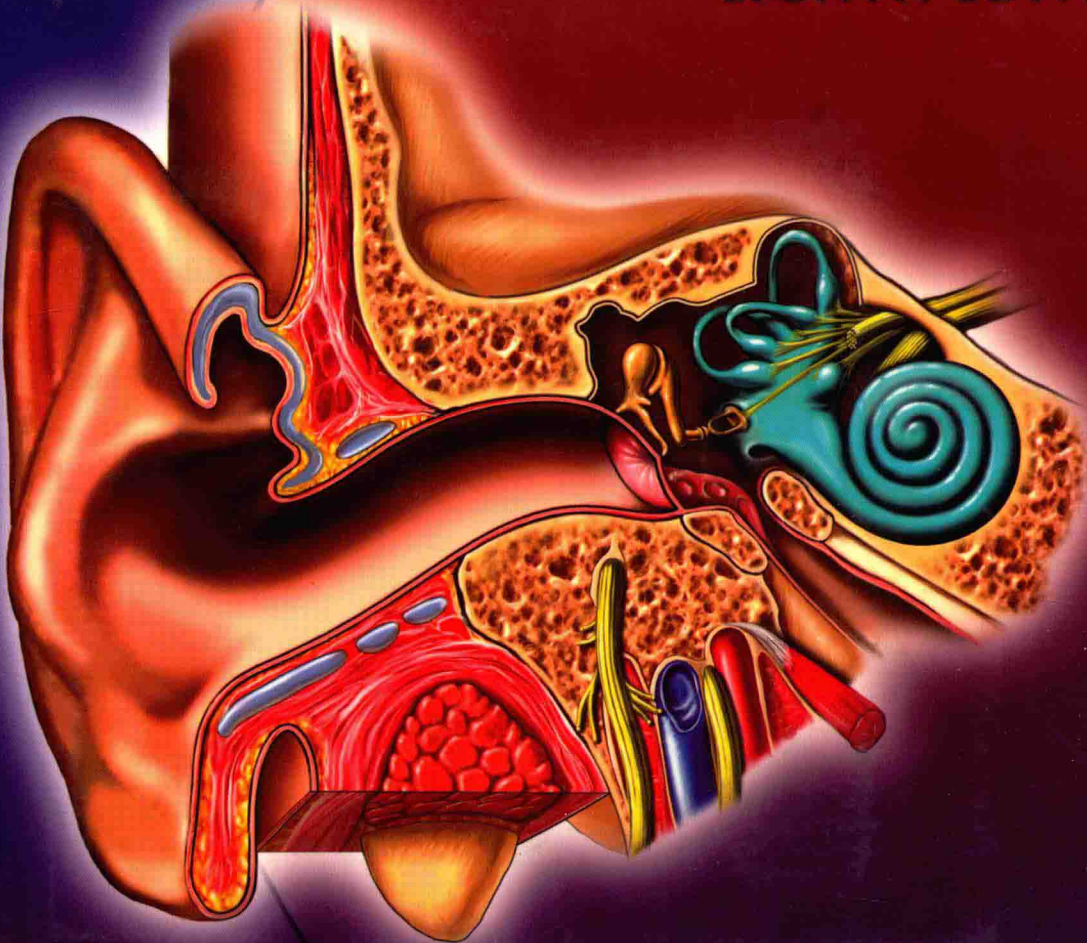


Introduction to

AUDIOLOGY

CD-ROM
INCLUDED

EIGHTH EDITION



FREDERICK N. MARTIN
JOHN GREER CLARK

Introduction to Audiology

EIGHTH EDITION

Frederick N. Martin

The University of Texas at Austin

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HearUSA and Helix Hearing Care of America



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To Cathy for her never ending love and support.

FNM

*To Holly for all that she's been, Ian and Emilie for all that they
will be, and Suzanne for all that she is that makes my life complete.*

JGC

Preface

Despite their considerable insights, the founders of audiology could not have envisioned the many ways in which this profession would evolve to meet the needs of children and adults with hearing impairments. Breakthroughs continue to come in areas related to the study of audition that include the principles of human hearing and the diagnosis and treatment of hearing loss. The profession is more exciting today than ever before.

Since treatment is our goal, and that is impossible without diagnosis, some people have developed the erroneous opinion that audiology is about doing hearing tests. Surely, testing the hearing function is essential; however, many tests could be performed by technical personnel who lack the education required to be total hearing healthcare managers. Historically, the profession has rejected this approach and has developed a model wherein one highly trained, self-supervised audiologist carries the patient and family from history taking through diagnosis and into patient management.

A new degree, the Doctor of Audiology (Au.D.), has emerged that expands the education and training of prospective audiologists and provides a level of prestige not heretofore seen. To date, those practicing audiology with an earned doctorate usually obtained a doctor of philosophy degree (Ph.D.), which places an emphasis on research in audition and not on clinical matters. The Au.D. is intended to replace the master's degree as the entry degree of audiological practice and to restore the Ph.D. to the position of a scholarly research degree. Holders of the Au.D. might function as supervisors of individuals who carry out technical duties, leaving them free for patient management. As the Au.D. will soon become the entry level degree to meet licensing and certification requirements, programs are being developed to provide the opportunity to upgrade to the Au.D. for practicing audiologists or those about to enter the profession with a master's degree. Certainly, however, once an audiology license has been granted, the professional can continue to practice regardless of the degree held.

Through its history of more than a quarter of a century, this book has been used by students in classes ranging from introductory to advanced levels. Students have used it who plan to enter the professions of audiology, speech-language pathology, and education of children with hearing loss. All of these individuals are charged with knowing all they can about hearing loss and its ramifications. To know less is to do a disservice to those children and adults who rely on us for assistance. It is difficult to envision a more rewarding or exciting way to spend a professional career.

How to Use This Book

The chapter arrangement in this book differs somewhat from traditional audiology texts in several ways. The usual approach is to present the anatomy and physiology of the ear and then to introduce auditory tests. After an introduction to the profession of audiology, this book first presents a superficial look at how the ear works. With this conceptual beginning, details of auditory tests can be understood as they relate to the basic mechanisms of hearing. Thus, with a grasp of the test principles, the reader is better prepared to benefit from the many examples of theoretical test results that illustrate different disorders in the auditory system. Presentations of anatomy and physiology, designed for greater detail and application, follow the descriptions of auditory disorders.

The organization of this book has proved useful because it facilitates early comprehension of what is often perceived as difficult material. Readers who wish a more traditional approach may simply rearrange the sequence in which they read the chapters. Chapters 9 through 12, on the anatomy, physiology, disorders, and treatments of different parts of the auditory apparatus, can simply be read before Chapters 4 through 8 on auditory tests. At the completion of the book, the same information will have been covered.

The teacher of an introductory audiology course may feel that the depth of coverage of some subjects in this book is greater than desired. If this is the case, the primary and secondary headings allow for easy identification of sections that may be deleted. If greater detail is desired, the suggested reading lists at the end of each chapter can provide more depth. The book may be read in modules, so that only specified materials are covered.

Each chapter in this book begins with an introduction to the subject matter and a statement of instructional objectives. Liberal use is made of headings, subheadings, illustrations, and figures. A summary at the end of each chapter repeats the important portions. Terms that may be new or unusual appear in **boldface** print and are defined in a glossary at the end the text, thus eliminating the reader's need to underscore or highlight important words or concepts. In addition, review tables summarize the high points of each chapter. Readers wishing to test their understanding of different materials may find the questions at the end of each chapter useful for checking their grasp of new information.

The indexes at the back of this book are intended to help readers to find desired materials rapidly. In the Author Index, page numbers in *italics* direct the reader to complete book or journal references by a particular author.

Rather than placing adjunct material in appendices as in early editions of this book, this material has been placed within an accompanying CD-ROM. This has allowed for an expansion of the

material provided to students, much of which will prove useful as they begin their professional careers. Materials on the CD-ROM include:

Anatomy—Schemata of anatomical views of the outer ear, middle ear, inner ear, and central auditory pathways.

Audiograms—Examples of audiological test tones and sample audiograms.

Cochlear Implants—Series of slides illustrating cochlear implantation devices.

Earmolds—A full tutorial for earmold fabrication.

Ear Pathology—Color photographs of a wide array of ear pathologies.

Hearing Aids—A wide variety of hearing aids and assistive listening devices

Resources—A number of handouts to enhance communication, hearing aid adaptation, classroom management, tinnitus understanding, infection control, and more; statements of audiological scope of practice and code of ethics; common audiological abbreviations, prefixes, and suffixes; variety of forms for clinical adaptation; lists of professional organizations and textbook publishers.

Simulated Hearing Loss—Filtered speech demonstrations of increasing losses of higher frequencies.

A second CD-ROM, entitled *Interactive Audiology*, has been prepared that tracks the materials in this book chapter by chapter. To test comprehension of materials studied, different question styles are presented, along with problem-solving exercises, labeling, and so on. Answers to the questions can be provided instantly. By using this book in tandem with the attached CD-ROM and *Interactive Audiology*, serious students can quickly diagnose any deficiencies they may have had in learning the material or satisfy themselves that the content is, in fact, mastered. *Interactive Audiology* also contains a series of case studies, which the user may solve based on the data provided. Instant feedback to the correct diagnosis is given. A final section of *Interactive Audiology* provides a series of movies demonstrating a variety of aspects of audiological practice.

The authors would like to thank the following reviewers for their time and input: Don E. Hagness, Eastern Kentucky University; Jacqueline D. Niedringhaus, Winthrop University; Andrew Stuart, East Carolina University; Bopanna B. Ballachanda, University of New Mexico; and Gary J. Beeby, Oklahoma State University.

About the Authors

Frederick N. Martin (Ph.D., The City University of New York), holds the Lillie Hage Jamail Centennial Professorship in Communication Sciences and Disorders at The University of Texas at Austin. His specialty is clinical audiology, and he has particular interests in the area of patient/parent counseling. Books authored by Dr. Martin include the first seven editions of *Introduction to Audiology*, as well as the first four editions of *Introduction to Audiology: A Study Guide*, *Exercises in Audiometry*, *Clinical Audiometry and Masking*, and *Basic Audiometry*. Dr. Martin has also edited *Pediatric Audiology*, *Medical Audiology*, *Hearing Disorders in Children*, and the ten-volume series *Remediation of Communication Disorders*. He has co-edited *Effective Counseling in Audiology*, *Hearing Care for Children*, and *Communication Sciences and Disorders: From Science to Clinical Practice*. In addition, he has written twenty-one book chapters, 120 journal articles, and 102 convention or conference papers. During his more than thirty-three years at The University of Texas, he has won the Teaching Excellence Award of the College of Communication, the Graduate Teaching Award, and the Advisor's Award from the Texas Alumni Association. He was the 1997 recipient of the Career Award in Hearing from the American Academy of Audiology. He serves as a reviewer for the most prominent audiology journals, and for years co-edited *Audiology—A Journal for Continuing Education*.

John Greer Clark (Ph.D., University of Cincinnati) is the Director of Clinical Services for Helix Hearing Care of America and HearUSA and has specialty interests in audiological counseling and hearing instrumentation. He is co-editor of *Tinnitus and Its Management, A Clinical Text for Audiologists* and author of the professional guide *Audiology for the School Speech-Language Clinician* and the consumer guide *The ABCs to Better Hearing*. His nearly sixty publications cover a variety of aspects of communication disorders. Dr. Clark has received the Honors of the Ohio Speech and Hearing Association as well as both the Prominent Alumni and Distinguished Alumni Awards from the University of Cincinnati Department of Communication Sciences and Disorders. He served four years on the Boards of Directors for the Ohio Academy of Audiology and the American Academy of Audiology. A co-founder of the Midwest Audiology Conference, he has been an Associate Editor, editorial consultant, and reviewer for several professional journals.

Drs. Martin and Clark are both Fellows of the American Academy of Audiology and the American Speech-Language-Hearing Association. Together they have co-edited two academic texts—*Effective Counseling in Audiology: Perspectives and Practice* and *Hearing Care for Children*—and co-authored the fifth edition of *Introduction to Audiology: A Review Manual*. In addition to their work together on the seventh and eighth editions of *Introduction to Audiology* and the accompanying CD-ROM, they have collaborated on research for the periodical scientific literature. They have recently released *Interactive Audiology*, a CD-ROM that provides instructional videos, case studies, and a wide variety of practice and learning exercises.

Contents

<i>Preface</i>	xiii
<i>How to Use This Book</i>	xv
<i>About the Authors</i>	xvii

Part ONE • *Elements of Audiology* **1**

1 *The Profession of Audiology* **3**

<i>Chapter Objectives</i>	3
<i>The Evolution of Audiology</i>	3
<i>Prevalence and Impact of Hearing Loss</i>	5
<i>Audiology Specialties</i>	7
<i>Employment Settings</i>	8
<i>Professional Societies</i>	9
<i>Summary</i>	10
<i>Study Questions</i>	11
<i>References</i>	11
<i>Suggested Readings</i>	11

2 *The Human Ear and Simple Tests of Hearing* **12**

<i>Chapter Objectives</i>	12
<i>Anatomy and Physiology of the Ear</i>	12
<i>Pathways of Sound</i>	13
<i>Types of Hearing Loss</i>	15

<i>Hearing Tests</i>	15
<i>Tuning Fork Tests</i>	16
<i>Summary</i>	20
<i>Study Questions</i>	21
<i>Suggested Readings</i>	21

3 *Sound and Its Measurement* 23

<i>Chapter Objectives</i>	23
<i>Sound</i>	23
<i>Waves</i>	24
<i>Vibrations</i>	27
<i>Frequency</i>	28
<i>Resonance</i>	29
<i>Sound Velocity</i>	30
<i>Wavelength</i>	30
<i>Phase</i>	31
<i>Complex Sounds</i>	33
<i>Intensity</i>	35
<i>The Decibel</i>	38
<i>Environmental Sounds</i>	44
<i>Psychoacoustics</i>	45
<i>Impedance</i>	48
<i>Sound Measurement</i>	49
<i>Summary</i>	61
<i>Study Questions</i>	61
<i>References</i>	62
<i>Suggested Readings</i>	62

Part TWO • Hearing Assessment 65

4 *Pure-Tone Audiometry* 67

<i>Chapter Objectives</i>	67
<i>The Pure-Tone Audiometer</i>	67

<i>Test Environment</i>	68
<i>The Patient's Role in Manual Pure-Tone Audiometry</i>	72
<i>The Clinician's Role in Manual Pure-Tone Audiometry</i>	74
<i>Air-Conduction Audiometry</i>	76
<i>Bone-Conduction Audiometry</i>	84
<i>Audiogram Interpretation</i>	87
<i>Masking</i>	94
<i>The Audiometric Weber Test</i>	104
<i>Automatic Audiometry</i>	104
<i>Computerized Audiometry</i>	106
<i>Summary</i>	106
<i>Study Questions</i>	107
<i>References</i>	107
<i>Suggested Readings</i>	108

5 *Speech Audiometry* 110

<i>Chapter Objectives</i>	110
<i>The Diagnostic Audiometer</i>	110
<i>Test Environment</i>	111
<i>The Patient's Role in Speech Audiometry</i>	111
<i>The Clinician's Role in Speech Audiometry</i>	112
<i>Speech-Threshold Testing</i>	112
<i>Masking for SRT</i>	119
<i>Bone-Conduction SRT</i>	121
<i>Most Comfortable Loudness Level</i>	122
<i>Uncomfortable Loudness Level</i>	122
<i>Range of Comfortable Loudness</i>	123
<i>Speech-Recognition Testing</i>	123
<i>Computerized Speech Audiometry</i>	135
<i>Summary</i>	135
<i>Study Questions</i>	139
<i>References</i>	139
<i>Suggested Readings</i>	141

6 *Objective Tests of the Auditory System* **143**

<i>Chapter Objectives</i>	143
<i>Acoustic Immittance</i>	143
<i>Acoustic Reflexes</i>	153
<i>Otoacoustic Emissions (OAE)</i>	158
<i>Auditory Evoked Potentials</i>	161
<i>Summary</i>	172
<i>Study Questions</i>	173
<i>References</i>	173
<i>Suggested Readings</i>	174

7 *Behavioral Tests for Site of Lesion* **175**

<i>Chapter Objectives</i>	175
<i>Loudness Recruitment</i>	176
<i>The Short Increment Sensitivity Index</i>	179
<i>Tone Decay</i>	180
<i>Békésy Audiometry</i>	182
<i>Summary</i>	184
<i>Study Questions</i>	184
<i>References</i>	185
<i>Suggested Readings</i>	185

8 *Hearing Tests for Children* **187**

<i>Chapter Objectives</i>	187
<i>Auditory Responses</i>	187
<i>Identifying Hearing Loss in Infants under 3 Months of Age</i>	188
<i>Objective Testing in Routine Pediatric Hearing Evaluation</i>	194
<i>Behavioral Testing of Children from Birth to Approximately 2 Years of Age</i>	197
<i>Behavioral Testing of Children Approximately 2 to 5 Years of Age</i>	201

<i>Language Disorders</i>	207
<i>Auditory Processing Disorders</i>	209
<i>Psychological Disorders</i>	210
<i>Developmental Disabilities</i>	210
<i>Identifying Hearing Loss in the Schools</i>	210
<i>Nonorganic Hearing Loss in Children</i>	215
<i>Summary</i>	215
<i>Study Questions</i>	216
<i>References</i>	216
<i>Suggested Readings</i>	218

Part THREE • Hearing Disorders 219

9 The Outer Ear 221

<i>Chapter Objectives</i>	221
<i>Anatomy and Physiology of the Outer Ear</i>	221
<i>Development of the Outer Ear</i>	226
<i>Hearing Loss and the Outer Ear</i>	227
<i>Disorders of the Outer Ear and Their Treatments</i>	227
<i>Summary</i>	235
<i>Study Questions</i>	235
<i>References</i>	236
<i>Suggested Readings</i>	236

10 The Middle Ear 237

<i>Chapter Objectives</i>	237
<i>Anatomy and Physiology of the Middle Ear</i>	237
<i>Development of the Middle Ear</i>	244
<i>Hearing Loss and the Middle Ear</i>	244

<i>Disorders of the Middle Ear and Their Treatments</i>	245
<i>Other Causes of Middle-Ear Hearing Loss</i>	269
<i>Summary</i>	270
<i>Study Questions</i>	271
<i>References</i>	271
<i>Suggested Readings</i>	272

11 *The Inner Ear* 274

<i>Chapter Objectives</i>	274
<i>Anatomy and Physiology of the Inner Ear</i>	274
<i>Development of the Inner Ear</i>	287
<i>Hearing Loss and Disorders of the Inner Ear</i>	288
<i>Causes of Inner-Ear Disorders</i>	289
<i>Summary</i>	309
<i>Study Questions</i>	310
<i>References</i>	310
<i>Suggested Readings</i>	311

12 *The Auditory Nerve and Central Auditory Pathways* 313

<i>Chapter Objectives</i>	313
<i>Anatomy and Physiology of the Auditory Nerve and Ascending Auditory Pathways</i>	314
<i>The Descending Auditory Pathways</i>	317
<i>Development of the Auditory Nerve and Central Auditory Nervous System</i>	318
<i>Summary of the Auditory Pathways</i>	318
<i>Hearing Loss and the Auditory Nerve and Central Auditory Pathways</i>	318
<i>Disorders of the Auditory Nerve</i>	311
<i>Disorders of the Cochlear Nuclei</i>	327
<i>Disorders of the Higher Auditory Pathways</i>	329
<i>Tests for Auditory Processing Disorders</i>	331
<i>Therapeutic Management</i>	340

<i>Summary</i>	341
<i>Study Questions</i>	342
<i>References</i>	342
<i>Suggested Readings</i>	344

13 *Nonorganic Hearing Loss* **346**

<i>Chapter Objectives</i>	346
<i>Terminology</i>	346
<i>Patients with Nonorganic Hearing Loss</i>	347
<i>Tests for Nonorganic Hearing Loss</i>	350
<i>Management of Patients with Nonorganic Hearing Loss</i>	357
<i>Summary</i>	358
<i>Study Questions</i>	358
<i>References</i>	359
<i>Suggested Readings</i>	360

Part FOUR • Management of Hearing Loss **361**

14 *Amplification/Sensory Systems* **363**

<i>Chapter Objectives</i>	363
<i>Hearing Aid Development</i>	363
<i>Hearing Aid Circuit Overview</i>	365
<i>Characteristic of Hearing Aids</i>	366
<i>Binaural Amplification</i>	369
<i>Types of Hearing Aids</i>	370
<i>Selecting Hearing Aid Candidates</i>	382
<i>Dispensing Hearing Aids</i>	385
<i>Verifying Hearing Aid Performance</i>	386
<i>Hearing Assistance Technologies</i>	388

<i>Summary</i>	392
<i>Study Questions</i>	392
<i>References</i>	392
<i>Suggested Readings</i>	394

15 *Audiological Treatment* 395

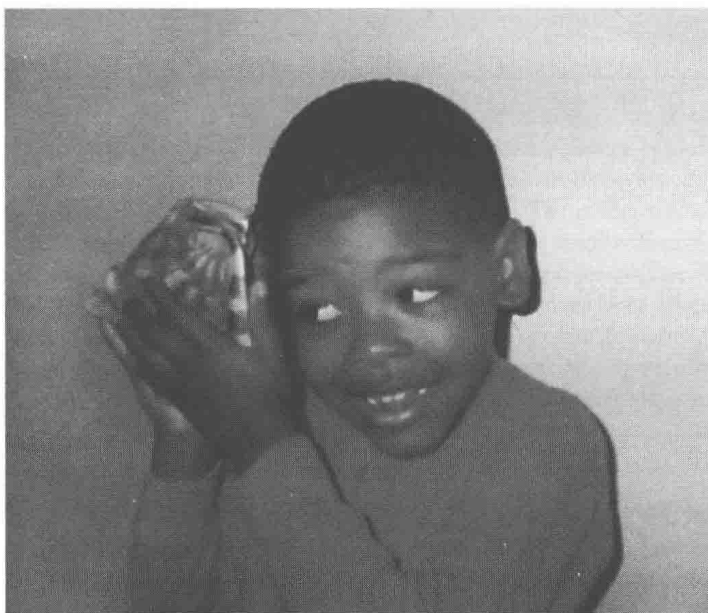
<i>Chapter Objectives</i>	395
<i>Patient Histories</i>	395
<i>Referral to Other Specialists</i>	396
<i>Audiological Counseling</i>	403
<i>Management of Adult Hearing Impairment</i>	409
<i>Management of Childhood Hearing Impairment</i>	413
<i>The Deaf Community</i>	419
<i>Management of Tinnitus</i>	419
<i>Hyperacusis</i>	421
<i>Vestibular Rehabilitation</i>	422
<i>Multicultural Considerations</i>	422
<i>Summary</i>	423
<i>Study Questions</i>	424
<i>References</i>	424
<i>Suggested Readings</i>	426

<i>Glossary</i>	427
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<i>Author Index</i>	443
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<i>Subject Index</i>	451
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Elements of Audiology



The first part of this book requires no foreknowledge. Chapter 1 presents an overview of the profession of audiology, its history and directions for the future. Chapter 2 is an elementary look at the anatomy of the auditory system, to the extent that basic types of hearing loss and simple hearing tests can be understood. Oversimplifications are clarified in later chapters. Tuning-fork tests are described here for three purposes: first, because they are practiced today by many physicians; second, because they are an important part of the history of the art and science of audiology; and third, because they illustrate some fundamental concepts that are essential to understanding contemporary hearing tests. Chapter 3 discusses the physics of sound and introduces the units of measurement that are important in performing modern audiological assessments. Readers who have had a course in hearing science may find little new information in Chapter 3 and may wish to use it merely as a review. For those readers for whom this material is new, its comprehension is essential for understanding what follows in this book.