

# COMMUNICATION SCIENCES AND DISORDERS

*From Science to Clinical Practice*

SECOND EDITION

**Ronald B. Gillam, PhD**  
Raymond L. and Eloise H. Lillywhite Professor  
Utah State University  
Logan, Utah

**Thomas P. Marquardt, PhD**  
Ben H. Love Regents Professor  
The University of Texas at Austin  
Austin, Texas

**Frederick N. Martin, PhD**  
Jamail Centennial Professor Emeritus  
The University of Texas at Austin  
Austin, Texas



**JONES AND BARTLETT PUBLISHERS**

*Sudbury, Massachusetts*

BOSTON TORONTO LONDON SINGAPORE

© Jones and Bartlett Publishers, LLC. NOT FOR SALE OR DISTRIBUTION.

*World Headquarters*  
Jones and Bartlett Publishers  
40 Tall Pine Drive  
Sudbury, MA 01776  
978-443-5000  
info@jbpub.com  
www.jbpub.com

Jones and Bartlett Publishers  
Canada  
6339 Ormindale Way  
Mississauga, Ontario L5V 1J2  
Canada

Jones and Bartlett Publishers  
International  
Barb House, Barb Mews  
London W6 7PA  
United Kingdom

Jones and Bartlett's books and products are available through most bookstores and online booksellers. To contact Jones and Bartlett Publishers directly, call 800-832-0034, fax 978-443-8000, or visit our website [www.jbpub.com](http://www.jbpub.com).

Substantial discounts on bulk quantities of Jones and Bartlett's publications are available to corporations, professional associations, and other qualified organizations. For details and specific discount information, contact the special sales department at Jones and Bartlett via the above contact information or send an email to [specialsales@jbpub.com](mailto:specialsales@jbpub.com).

Copyright © 2011 by Jones and Bartlett Publishers, LLC

All rights reserved. No part of the material protected by this copyright may be reproduced or utilized in any form, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission from the copyright owner.

Unless otherwise indicated, all photographs and illustrations are under copyright of Jones and Bartlett Publishers, LLC.

The authors, editor, and publisher have made every effort to provide accurate information. However, they are not responsible for errors, omissions, or for any outcomes related to the use of the contents of this book and take no responsibility for the use of the products and procedures described. Treatments and side effects described in this book may not be applicable to all people; likewise, some people may require a dose or experience a side effect that is not described herein. Drugs and medical devices are discussed that may have limited availability controlled by the Food and Drug Administration (FDA) for use only in a research study or clinical trial. Research, clinical practice, and government regulations often change the accepted standard in this field. When consideration is being given to use of any drug in the clinical setting, the health care provider or reader is responsible for determining FDA status of the drug, reading the package insert, and reviewing prescribing information for the most up-to-date recommendations on dose, precautions, and contraindications, and determining the appropriate usage for the product. This is especially important in the case of drugs that are new or seldom used.

#### **Production Credits**

Publisher: David Cella	Composition: Shawn Girsberger
Associate Editor: Maro Gartside	Cover Design: Kristin E. Parker
Editorial Assistant: Teresa Reilly	Cover Image Credit: © zhuda/ Shutterstock, Inc.
Production Editor: Amanda Clerkin	Photo Researcher: Carolyn Arcabascio
Marketing Manager: Grace Richards	Printing and Binding: Malloy, Inc.
Manufacturing and Inventory Control Supervisor: Amy Bacus	Cover Printing: Malloy, Inc.

#### **Library of Congress Cataloging-in-Publication Data**

Communication sciences and disorders : from science to clinical practice / [edited by] Ronald B. Gillam, Thomas Marquardt, and Frederick Martin. — 2nd ed.

p. ; cm.

Includes bibliographical references and index.

ISBN-13: 978-0-7637-7975-7 (alk. paper)

ISBN-10: 0-7637-7975-X (alk. paper)

1. Communicative disorders. I. Gillam, Ronald B. (Ronald Bradley), 1955- II. Marquardt, Thomas P. III. Martin, Frederick N. [DNLM: 1. Communication Disorders. 2. Communication. 3. Speech--physiology. WL 340.2 C7344 2011]

RC423.C647 2011

616.85'5--dc22

2009038822

6048

Printed in the United States of America

14 13 12 11 10 9 8 7 6 5 4 3 2 1

© Jones and Bartlett Publishers, LLC. NOT FOR SALE OR DISTRIBUTION.

☞ *To Sandi, whose love and encouragement means everything to me.*  
—Ronald B. Gillam

☞ *To Barbara.*  
—Thomas P. Marquardt

☞ *To my many students who made mine a wonderful career.*  
—Frederick N. Martin



# Contents

Preface	xi
Acknowledgments	xiii
Contributors	xv

---

## *section I*

<b>GENERAL CONSIDERATIONS</b>	<b>1</b>
-------------------------------	----------

---

### *chapter one*

<b>An Introduction to the Discipline of Communication Sciences and Disorders</b>	<b>3</b>
<i>Ronald B. Gillam and Sandra Laing Gillam</i>	
The Discipline	4
Individuals With Communication Disorders	5
Types of Communication Disorders	7
The Professions	13
Professional and Scholarly Associations	18
Regulation	19
Ethics	20
Summary	22
Study Questions	24
Key Terms	25
References	25
Suggested Readings	25

### *chapter two*

<b>Communication Across the Life Span</b>	<b>27</b>
<i>Ronald B. Gillam, Lisa M. Bedore, and Barbara L. Davis</i>	
The Process of Language Production and Comprehension	29
The Building Blocks of Speech	30
The Building Blocks of Language	32
The Development of Speech and Language	34
From Crying to Short Phrases: Ages 0 to 24 Months	36
From Early Sentences to Stories: Ages 2 to 5 Years	39

From Oral Language to Written Language: The School-Age Years	42
Adulthood	46
Summary	48
Study Questions	49
Key Terms	50
References	50
Suggested Readings	50

### *chapter three*

#### **The Social and Cultural Bases of Communication** 51

*Elizabeth D. Peña and Janice E. Jackson*

The Social Context of Communication	52
Socialization: Learning the Rules of Family and Society	53
What Should We Do If There Is a Mismatch?	56
Dialects and Bilingualism	58
Summary	67
Study Questions	68
Key Terms	68
References	69
Suggested Readings	69

---

### *section II*

#### **INDIVIDUALS WITH SPEECH DISORDERS** 71

---

### *chapter four*

#### **Speech Science** 73

*Thomas P. Marquardt and Christine L. Matyear*

Nervous System	74
Central Nervous System	76
Peripheral Nervous System	78
Hemispheric Specialization/Localization of Function	79
Motor Pathways	82
Respiration	83
Phonation	88
Summary	100
Study Questions	101
Key Terms	101
References	102
Suggested Readings	102

*chapter five*

<b>Developmental Speech Disorders</b>	<b>103</b>
<i>Barbara L. Davis and Lisa M. Bedore</i>	
Definition and Incidence	105
A Framework for Understanding Articulation and Phonology	106
Articulation and Phonological Disorders	107
Assessment and Treatment	112
Summary	119
Study Questions	120
Key Terms	120
References	120
Suggested Readings	121

*chapter six*

<b>Laryngeal and Orofacial Disorders</b>	<b>123</b>
<i>Rodger Dalston and Thomas P. Marquardt</i>	
Voice Disorders	124
Vocal Fold Abnormalities That Affect Voice	126
Voice Disorders Resulting from Neurological Impairment	130
Vocal Abnormalities Unrelated to Structural Change	132
The Voice Evaluation	133
Laryngectomy	136
Oral-Facial Clefts: An Overview	139
How Clefts of the Lip and Palate Develop	140
The Speech of Children with Cleft Lip and Palate	143
Management of Patients With Oral-Facial Clefts	145
Summary	148
Study Questions	150
Key Terms	150
Suggested Readings	150

*chapter seven*

<b>Fluency Disorders</b>	<b>153</b>
<i>Courtney T. Byrd and Ronald B. Gillam</i>	
The Nature of Fluent Speech	154
What Is Stuttering?	156
Individuals Who Stutter	158
The Cause of Stuttering	161
The Development of Stuttering	162
Factors That Contribute to Chronic Stuttering	166
Assessment of Stuttering	168
Treatment	173
Summary	178

Study Questions	179
Key Terms	179
References	179
Suggested Readings	180

## *chapter eight*

<b>Dysarthria</b>	<b>181</b>
<i>Thomas P. Marquardt</i>	
Cerebral Palsy	182
Acquired Dysarthria	187
Assessment of Individuals With Dysarthria	191
Treatment of Individuals With Dysarthria	193
Augmentative Communication	194
Summary	198
Study Questions	199
Key Terms	199
References	199
Suggested Readings	200

## *chapter nine*

<b>Dysphagia</b>	<b>201</b>
<i>Dena Granof</i>	
Examples of Dysphagia	202
Role of the Speech-Language Pathologist	203
Stages of Swallowing	204
Dysphagia in Adults	207
Management of Adult Dysphagia	208
Dysphagia in Children	212
Summary	216
Study Questions	216
Key Terms	216
References	216
Suggested Readings	217

---

## *section III*

<b>INDIVIDUALS WITH LANGUAGE DISORDERS</b>	<b>219</b>
--	------------

---

## *chapter ten*

<b>Language Disorders in Infants, Toddlers, and Preschoolers</b>	<b>221</b>
<i>Elizabeth D. Peña and Barbara L. Davis</i>	
Children With Developmental Language Disorders	223
Disorders of Form, Content, and Use	226
Service Delivery	231

Assessment	233
Intervention	239
Summary	240
Study Questions	243
Key Terms	243
References	243
Suggested Readings	244

## *chapter eleven*

<b>Language Disorders in School-Age Children</b>	<b>245</b>
<i>Ronald B. Gillam and Douglas B. Petersen</i>	
Services for School-Age Children	247
Language Disorders	252
Critical Areas of Language Development During the School-Age Years	255
Assessment	259
Intervention	263
Summary	266
Study Questions	268
Key Terms	268
References	268
Suggested Readings	270

## *chapter twelve*

<b>Acquired Neurogenic Language Disorders</b>	<b>271</b>
<i>Thomas P. Marquardt and Swathi Kiran</i>	
Causes of Brain Damage	272
Aphasia	273
Assessment and Diagnosis of Aphasia	281
The Treatment of Aphasia	283
Right Hemisphere Communication Deficits	285
Summary	289
Study Questions	289
Key Terms	290
References	290
Suggested Readings	290

---

## *section IV*

<b>HEARING AND HEARING DISORDERS</b>	<b>293</b>
--------------------------------------	------------

---

## *chapter thirteen*

<b>Hearing Science</b>	<b>295</b>
<i>Craig A. Champlin</i>	
Fundamentals of Sound	296

The Auditory System: Structure and Function	302
The Middle Ear	304
Summary	314
Study Questions	314
Key Terms	315
Suggested Readings	315

## *chapter fourteen*

### **Hearing Disorders** **317**

*Frederick N. Martin*

Hearing Tests	318
Types of Hearing Loss	325
Summary	332
Study Questions	334
Key Terms	334
References	334
Suggested Readings	335

## *chapter fifteen*

### **Audiologic Rehabilitation** **337**

*Margaret S. Dean and John A. Nelson*

Personal Hearing Devices	338
Difficult Listening Environments	349
Alerting Devices	352
Audiologic Habilitation	352
Audiologic Rehabilitation	356
Summary	359
Study Questions	360
Key Terms	361
References	361
Suggested Readings	361

## *chapter sixteen*

### **The Habilitation of Children With Severe to Profound Hearing Loss** **363**

*Mark E. Bernstein*

Hearing Impairment and Development	365
Summary	373
Study Questions	375
Key Terms	375
References	375
Suggested Readings	376

Glossary	377
Index	395

# Preface

This book was written for undergraduate students who are enrolled in their first course in communication sciences and disorders. We wrote it with two important assumptions in mind. First, we assumed that the students who read this book would have relatively little prior knowledge about the scientific study of communication, the nature of communication disorders, or the professions of audiology and speech-language pathology. Second, we assumed that if students found the content of this book to be interesting, they would be likely to enroll in courses that would examine most of the topics that are included in this book in much greater detail.

Given these assumptions, we focused on providing the reader with a wide-angle view of communication sciences and disorders. We wanted to show the considerable forest that is communication sciences and disorders without having to focus on too many individual trees. Whenever possible, we selected a wide-angle lens rather than a narrow lens. Readers should get a sense of the variety of topics that speech, language, and hearing scientists study and the variety of individuals that audiologists and speech-language pathologists treat.

Like many introductory texts, the book contains basic information about speech disorders that are related to impairments in articulation, voice, and fluency; language disorders in children and adults; and hearing disorders that cause conductive and sensorineural hearing losses. We also include basic information on the speech, language, and hearing sciences and practical information about assessment and intervention practices. Finally, readers will be happy to note that this book includes chapters on multicultural issues, deafness, dysarthria, and dysphagia.

We do not want to tell readers everything we know about each topic. To this end, we describe only the most critical concepts in detail, provide many examples, and cite only seminal works. If we have selected our topics wisely and have explained them well, the content of this book will provide students with the background knowledge they need to get the most out of subsequent undergraduate and graduate courses.

Finally, we have provided students with a means for seeing and hearing the human communication disorders they are reading about. The CD-ROM that accompanies the book enables professors to provide information about common or unusual cases in a single, highly accessible format, and it enables students to watch the segments many times over to make the most of the enhanced learning opportunities they provide.

This second edition of this book includes a number of changes. We reorganized the sections so that they follow the way many instructors sequence their introductory classes. The text begins with overviews of the professions, the nature of communication across the life span, and social-cultural issues that affect communication and communication disorders. The second section examines the variety of speech disorders. We begin with a summary of basic principles of speech science, and then we provide chapters that focus on speech sound disorders in children, laryngeal and resonance disorders (combined into one chapter), fluency disorders, dysarthria, and dysphagia. The third section of the book concerns language disorders across the life span. We begin with language disorders in infants, toddlers, and preschoolers; move to a discussion of language disorders in school-age children; and then end the section with a discussion of acquired neurogenic language disorders. The last section of the book concerns hearing and hearing disorders. We begin with a summary of basic principles of hearing science, and then we provide a survey of hearing disorders and hearing testing, a summary of audiologic rehabilitation (hearing aids and cochlear implants), and a description of the education of students who are deaf or hard of hearing.

We want students in introductory courses to begin to understand what it means to have a communication disorder. We have added personal stories about events in our careers and case studies to the chapters to highlight the human side of the professions of speech-language pathology, audiology, and deaf education. We want these vignettes, together with the video segments on the CD-ROM, to demonstrate that the concepts and principles in the chapters relate to real people who have real needs that can be addressed by caring and well-educated professionals. We hope the students who read this book will find this subject matter to be both interesting and uplifting.

# Acknowledgments

Many people contributed to the creation of this book. We would like to thank Shannon Davenport, Tanja Jensen, Jennifer Gillam, Emily Swatner, Amy Montuoro, Bonnie Lindgren, Kristy Price, and Brittany Atwood for their helpful assistance in preparing the revised manuscript. At Jones and Bartlett Publishers, Maro Gartside provided a great deal of advice and encouragement at the most critical times.

A number of people assisted us in creating the CD-ROM. First, and foremost, LaVae Hoffman endured the hardship of working for many masters, none of whom understood the intricacies of multimedia development. Without her loyalty, ingenuity, and hard work, this project would not have been possible. We thank many of our colleagues and students who agreed to appear in the video segments. Grateful appreciation is extended to Mr. Chad Smiddy who created the embryologic morphing sequence of the human face.

Finally, the editors and authors thank those individuals with communication disorders and their family members who allowed their images and words to be included on the CD-ROM. We applaud their continuing struggle to compensate for or overcome their communication disorders, and we share their hope that their appearance on the CD-ROM will contribute to the education of the next generation of speech-language pathologists, audiologists, and deaf educators.



# Contributors

**Lisa Bedore**, PhD (CCC-SLP), is an associate professor in the Department of Communication Sciences and Disorders at the University of Texas at Austin. She teaches courses on language development, language disorders, and bilingualism. Her research interests are in the areas of language and phonological development in Spanish-English bilingual children with typically developing language skills and language disorders.

**Mark E. Bernstein**, EdD, is the associate dean for Student Affairs in the College of Communication at the University of Texas at Austin and the coordinator of the Deafness Studies/Deaf Education major in the Department of Communication Sciences and Disorders. His scholarly interests range from techniques for speech development in the deaf, to working with parents of children with hearing impairments, to descriptive studies of the use of simultaneous communication, to issues surrounding bilingual/bicultural (ASL/English) approaches to deaf education.

**Courtney Byrd**, PhD (CCC-SLP), is an assistant professor at the University of Texas at Austin and is the founder and director of the Austin Center for Stuttering Intervention and Research. She teaches courses in the Department of Communication Sciences and Disorders in assessment and treatment of child speech and language disorders, fluency disorders, and voice disorders. Her primary research focus is the contribution of linguistic and motor planning to developmental stuttering with a secondary focus on evidence-based practice for young children who stutter.

**Craig A. Champlin**, PhD (CCC-A), is the Lillie Hage Jamail Centennial Professor of Communication at the University of Texas at Austin. He has published research articles in the areas of psychoacoustics, auditory electrophysiology, and diagnostic audiology. Craig has served as the editor of the *Journal of Speech, Language, and Hearing Research*, chair of the Bioacoustics section of the American National Standards Institute and is a fellow of American Academy of Audiology and the American Speech-Language-Hearing Association.

**Rodger Dalston**, PhD (CCC-SP), is an emeritus professor in the Department of Communication Sciences and Disorders at the University of Texas at Austin. He taught courses in voice disorders, craniofacial anomalies, and research design. His primary

research interest concerned oral-facial clefts and their impact upon speech and language development.

**Barbara Davis**, PhD (CCC-SLP), is the Houston Harte Centennial Professor of Communication at the University of Texas at Austin. She teaches courses in the Department of Communication Sciences and Disorders in infant–toddler intervention, developmental speech disorders, and speech science. Her research interests focus on the interactive influences of production and perception on speech acquisition in typically developing children, children with speech disorders, and children with early identified hearing impairment.

**Margaret Dean**, PhD (CCC-A), is chief of Audiology and assistant professor at Texas A&M University at Scott & White Hospital in Temple, Texas, where she works as a clinical audiologist specializing in the areas of behavioral and electrophysiological diagnostic testing, hearing aids, cochlear implants, and central auditory processing testing. She has conducted research and published articles in the areas of bone conduction testing and the occlusion effect.

**Ronald Gillam**, PhD (CCC-SLP), holds the Raymond L. and Eloise H. Lillywhite chair in the Department of Communicative Disorders and Deaf Education at Utah State University, where he teaches courses on research methods and evidence-based practices. His research primarily concerns information processing, diagnostic markers of language impairments, language intervention procedures, and narrative development in school-age children and adults. He is a fellow of the American Speech-Language-Hearing Association.

**Sandra Laing Gillam**, PhD (CCC-SLP), is an associate professor in Communication Disorders and Deaf Education at Utah State University. She teaches courses in language development and disorders, phonological development and disorders, and literacy in school-age children. Her research interests include assessment and intervention for language and literacy impairments, multicultural populations, and processes involved in text comprehension.

**Dena Granof**, PhD (CCC-SLP), is a senior lecturer in Communication Sciences and Disorders at the University of Texas. She teaches courses in dysphagia and language disorders in children and adults. Her primary clinical interests are in assessment and treatment of communication and swallowing disorders in children with multiple handicaps.

**Janice E. Jackson**, PhD (CCC-SLP), is an assistant professor of Special Education and Speech-Language Pathology at the University of West Georgia. She teaches courses in language acquisition, language disorders, and literacy. Her research interests are related to language development, distinguishing language impairment from linguistic difference, and the use of psycholinguistics to develop nonbiased language assessment.

**Swathi Kiran**, PhD (CCC-SLP), is an associate professor in the Department of Speech and Hearing Sciences at Boston University. Her research interests focus around lexical semantic treatment for individuals with aphasia, bilingual aphasia, and neuroimaging

of brain plasticity following a stroke. Her papers have appeared in journals such as *Brain and Language*, *Aphasiology*, *Journal of Speech Language and Hearing Research*, and the *American Journal of Speech Language Pathology*.

**Thomas Marquardt**, PhD (CCC-SLP), is the Ben F. Love Regents professor in the Department of Communication Sciences and Disorders at The University of Texas. He conducts research on speech motor control disorders in children and adults and teaches courses on acquired neurogenic speech and language disorders in addition to introduction to communication disorders. He is a fellow of the American Speech-Language-Hearing Association.

**Frederick N. Martin**, PhD (CCC-A), is the Jamail Centennial Professor Emeritus in Communication Sciences and Disorders at The University of Texas at Austin. His research concerns diagnostic audiology, pediatric diagnosis, and counseling. He is a fellow of the American Academy of Audiology and the American Speech-Language-Hearing Association, has received the Career Award in Hearing from the American Academy of Audiology, and was the first to receive the Lifetime Achievement Award from the Texas Academy of Audiology.

**Christine L. Matyear**, PhD, is a senior lecturer in Communication Sciences and Disorders at the University of Texas at Austin. She teaches courses in phonetics, speech science, hearing science, anatomy and physiology, deafness, and research. Her research interests include speech acquisition in infants and the acoustic analysis of speech sounds.

**John A. Nelson**, PhD (CCC-A), is the director of Copenhagen Audiology, Research and Development for ReSound Group and resides in Denmark. His research focuses on psychoacoustics, amplification, and digital signal processing.

**Elizabeth Peña**, PhD (CCC-SLP), is a professor of Communication Sciences and Disorders at the University of Texas at Austin. She teaches courses in language development, language disorders, psychometrics, and bilingualism. Her research interests are in the areas of language development and assessment of Spanish English bilingual children with typically developing language skills and language disorders.

**Douglas Petersen**, PhD (CCC-SLP), is an assistant professor at the University of Wyoming. His clinical and research interests include the assessment and intervention of childhood language disorders, with a specific focus on narrative assessment and intervention, assessment and prevention of early literacy difficulties in bilingual children, and cultural/linguistic diversity.

