

Vocal Health and Pedagogy
Science, Assessment, and Treatment

Third Edition

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Science, Assessment, and Treatment

Third Edition

Robert Thayer Sataloff, MD, DMA





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Contents

Foreword by Denyce Graves-Montgomery	ix
Preface	xi
Acknowledgments to the Third Edition	xv
About the Author	xvii
Contributors	xxi
Dedication	xxvii
Chapter 1 Introduction <i>Robert Thayer Sataloff</i>	1
Chapter 2 The Singing Teacher in the Age of Voice Science <i>Richard Miller</i>	7
Chapter 3 Historical Overview of Voice Pedagogy <i>Richard Miller</i>	11
Chapter 4 Choral Pedagogy and Vocal Health <i>Brenda J. Smith and Robert Thayer Sataloff</i>	25
Chapter 5 Amateur and Professional Child Singers: Pedagogy and Related Issues <i>Valerie L. Trollinger and Robert Thayer Sataloff</i>	33
Chapter 6 Why Study Music? <i>Christin Coffee Rondeau</i>	47
Chapter 7 Medical Evaluation Prior to Voice Lessons: Another Controversy <i>Aaron J. Jaworek and Robert Thayer Sataloff</i>	49
Chapter 8 The Physics of Sound <i>Robert Thayer Sataloff</i>	53
Chapter 9 Music and the Brain <i>Thomas Swirsky-Sacchetti, Robert Rider, Michael E. Keesler, and Steven Mandel</i>	65
Chapter 10 Clinical Anatomy and Physiology of the Voice <i>Robert Thayer Sataloff</i>	79
Chapter 11 An Overview of Laryngeal Function for Voice Production <i>R. J. Baken</i>	119
Chapter 12 Laryngeal Function During Phonation <i>Ronald C. Scherer</i>	141
Chapter 13 Vocal Tract Resonance <i>Johan Sundberg</i>	169

Chapter 14	Voice Care Professionals: A Guide to Voice Care Providers <i>Robert Thayer Sataloff, Yolanda D. Heman-Ackah, and Mary J. Hawkshaw</i>	189
Chapter 15	Patient History <i>Robert Thayer Sataloff</i>	195
Chapter 16	Special Considerations Relating to Members of the Acting Profession <i>Bonnie N. Raphael</i>	219
Chapter 17	Physical Examination <i>Robert Thayer Sataloff</i>	223
Chapter 18	The Clinical Voice Laboratory <i>Jonathan J. Romak, Reinhardt J. Heuer, Mary J. Hawkshaw, and Robert Thayer Sataloff</i>	237
Chapter 19	Use of Instrumentation in the Singing Studio <i>Robert Thayer Sataloff</i>	271
Chapter 20	High-Speed Digital Imaging <i>Matthias Echternach</i>	275
Chapter 21	Evolution of Technology <i>Jonathan J. Romak and Robert Thayer Sataloff</i>	289
Chapter 22	Common Medical Diagnoses and Treatments in Patients With Voice Disorders: An Introduction and Overview <i>Robert Thayer Sataloff, Mary J. Hawkshaw, and Johnathan B. Sataloff</i>	295 295
Chapter 23	The Effects of Age on the Voice <i>Robert Thayer Sataloff, Karen M. Kost, and Sue Ellen Linville</i>	319
Chapter 24	Pediatric Voice Disorders <i>Alexander Manteghi, Amy Rutt, Robert Thayer Sataloff, and Caren J. Sokolow</i>	339
Chapter 25	Hearing Loss in Singers and Other Musicians <i>Robert Thayer Sataloff, Brian McGovern, Joseph Sataloff, and Morgan A. Selleck</i>	355
Chapter 26	Eye Care and the Performing Arts <i>Marcel J. Sislowitz</i>	373
Chapter 27	Endocrine Function <i>Timothy D. Anderson, Dawn D. Anderson, and Robert Thayer Sataloff</i>	377
Chapter 28	The Vocal Effects of Thyroid Disorders and Their Treatment <i>Julia A. Pfaff, Hilary Caruso-Sales, Aaron Jaworek, and Robert Thayer Sataloff</i>	393
Chapter 29	The Effects of Hormonal Contraception on the Voice <i>Jennifer P. Rodney and Robert Thayer Sataloff</i>	405
Chapter 30	Breast Cancer in Professional Voice Users <i>Dahlia M. Sataloff and Robert Thayer Sataloff</i>	411
Chapter 31	Autoimmune <i>Robert Thayer Sataloff and Michael S. Benninger</i>	417
Chapter 32	Psychological Aspects of Voice Disorders <i>Deborah Caputo Rosen, Reinhardt J. Heuer, David A. Sasso, and Robert Thayer Sataloff</i>	427

Chapter 33	Allergy <i>John R. Cohn, Patricia A. Padams, Mary J. Hawkshaw, and Robert Thayer Sataloff</i>	459
Chapter 34	Respiratory Dysfunction <i>Robert Thayer Sataloff, John R. Cohn, and Mary J. Hawkshaw</i>	465
Chapter 35	Pollution and Its Effects on the Voice <i>Robert Thayer Sataloff</i>	479
Chapter 36	Pyrotechnics in the Entertainment Industry: An Overview <i>Cynthia Del' Aria and David A. Opperman</i>	493
Chapter 37	Artificial Fogs and Smokes <i>Monona Rossol</i>	505
Chapter 38	Infectious and Inflammatory Disorders of the Larynx <i>Catherine F. Sinclair and Robert S. Lebovics</i>	513
Chapter 39	Pharyngitis <i>Mona M. Abaza and Robert Thayer Sataloff</i>	531
Chapter 40	Sleep and the Vocal Performer <i>Joanne E. Getsy, Robert Thayer Sataloff, and Julie A. Wang</i>	541
Chapter 41	Nutrition and the Professional Voice <i>Jennifer A. Nasser and Nyree Dardarian</i>	555
Chapter 42	Reflux and Other Gastroenterologic Conditions That May Affect the Voice <i>Robert Thayer Sataloff, Donald O. Castell, Philip O. Katz, Dahlia M. Sataloff, and Mary J. Hawkshaw</i>	577
Chapter 43	Seating Problems and Vocalists <i>Richard N. Norris</i>	669
Chapter 44	Bodily Injuries and Their Effects on the Voice <i>Robert Thayer Sataloff</i>	673
Chapter 45	Performing Arts Medicine and the Professional Voice User: Risks of Nonvoice Performance <i>William J. Dawson, Robert Thayer Sataloff, and Valerie L. Trollinger</i>	677
Chapter 46	Respiratory Behaviors and Vocal Tract Issues in Wind Instrumentalists <i>Valerie L. Trollinger and Robert Thayer Sataloff</i>	687
Chapter 47	Neurologic Disorders Affecting the Voice in Performance <i>Linda Dahl, Jessica W. Lim, Steven Mandel, Reena Gupta, and Robert Thayer Sataloff</i>	699
Chapter 48	Medications and the Voice <i>Robert Thayer Sataloff, Mary J. Hawkshaw, Joseph Anticaglia, Michelle White, Kirsten Meenan, and Jonathan J. Romak</i>	727
Chapter 49	Psychiatric Manifestations of Medications Prescribed Commonly in Otolaryngology <i>Steven H. Levy, Mona M. Abaza, Mary J. Hawkshaw, Robert Thayer Sataloff, and Reinhardt J. Heuer</i>	757
Chapter 50	Medications for Traveling Voice Performers <i>Robert Thayer Sataloff and Mary J. Hawkshaw</i>	761

Chapter 51	Introduction to Treating Voice Abuse <i>Robert Thayer Sataloff</i>	767
Chapter 52	Speech-Language Pathology and the Professional Voice User: An Overview <i>Carol N. Wilder</i>	771
Chapter 53	Voice Therapy <i>Bridget Rose, Michelle Horman, and Robert Thayer Sataloff</i>	775
Chapter 54	Voice Rest <i>Adam D. Rubin, Robert Thayer Sataloff, Susan E. Cline, Jean Skeffington, and Karen M. Lyons</i>	799
Chapter 55	Increasing Vocal Effectiveness <i>Bonnie N. Raphael and Robert Thayer Sataloff</i>	805
Chapter 56	The Singing Voice Specialist <i>Margaret M. Barody, Robert Thayer Sataloff, and Linda M. Carroll</i>	817
Chapter 57	The Role of the Acting-Voice Trainer in Medical Care of Professional Voice Users <i>Sharon L. Freed, Bonnie N. Raphael, and Robert Thayer Sataloff</i>	837
Chapter 58	Exercise Physiology: Perspective for Vocal Training <i>Mary J. Sandage and Matthew Hoch</i>	847
Chapter 59	The Effects of Posture on Voice <i>John S. Rubin, Ed Blake, Lesley Mathieson, and Hala Kanona</i>	853
Appendix I	International Phonetic Alphabet	863
Appendix II	A. Patient History: Singers	867
	B. Patient History: Professional Voice Users	875
Appendix III	A. Reading Passages	883
	B. Laryngeal Examination	885
Appendix IV	A. Outline for Daily Practice	887
	B. Sample Phrases	889
	C. Frontal Placement Words	892
	D. H/Vowel Minimal-Pairs	893
	E. Vowel-Initiated Words	894
	F. Phrases for Blending	895
	G. Phrases to Practice Easy Onset and Blending	896
	H. Homographs	897
	I. Open-Vowel Words	898
Appendix V	A. Singing Voice Specialist's Report	899
	B. Acting Voice Specialist's Report	901
Glossary		903
Index		923

Foreword

I don't know of anyone, in any profession, of any kind, who is as thoroughly and completely immersed and in love with the human voice as is Dr. Robert Sataloff. The name Dr. Sataloff is one that I have heard at every stage of my development as an artist. He is well known among singers and teachers as a specialist in caring for the professional voice, but it wasn't until I had the great fortune of becoming a patient, that I was fully able to appreciate his unquestionable brilliance.

In his sophisticated latest project, *Vocal Health and Pedagogy: Science, Assessment, and Treatment, Third Edition*, Dr. Sataloff has poured years of intricate research, knowledge, and experience into his "must have" vocal Bible for clinicians, voice teachers, singers, and coaches alike. It answers every question

you've ever had about the voice, from the physics of sounds, to vocal technique, to medications, to performance anxiety. Because Dr. Sataloff is himself a singer, composer, and conductor, he shares an affinity with his patients and with this material and is therefore aware of these many issues firsthand.

Vocal Health and Pedagogy leaves no stone unturned! And we are richer, healthier, and better prepared with less vocal worries and concerns for having this treasure trove of knowledge at our fingertips. This wealth of information will never exhaust, and we will refer to its pages for years to come. For anyone who loves the beauty of the human voice and the beauty of refined art, this work . . . itself a work of art, is for this generation and for generations to come. Molto Bravo Dr. Sataloff.

—Denyce Graves-Montgomery

Preface

The first and second editions of *Vocal Health and Pedagogy* were written as a companion book to *Professional Voice: The Science and Art of Clinical Care*. When I wrote the first edition of *Professional Voice: The Science and Art of Clinical Care*, which was published in 1991, I had hoped that it would be used not only as a medical text, but also for courses in vocal pedagogy and speech-language pathology. Although teachers in these fields found the book useful and helpful, only a few were comfortable using it in their courses because of the cost to their students. Now that the fourth edition of the book has expanded from 33 chapters in the first edition to 120 chapters in the fourth edition, the cost of the book has increased; and it has become virtually inaccessible to an important segment of the audience for whom it was written. Consequently, the third edition of *Vocal Health and Pedagogy* was written to make at least some of the information available to and affordable for students.

The first part of the book Introduces basic concepts of voice science, assessment, and training. **Chapter 1** provides perspective on modern voice medicine and a brief historical review of how knowledge about the larynx and voice has evolved over the centuries. Chapter 2 includes introductory information about the physics of sound. **Chapter 2**, The Singing Teacher in the Age of Voice Science, is a classic chapter by the late Richard Miller that was retained unchanged, as was his chapter (3) which provides an historical overview of voice pedagogy. **Chapter 4** includes not only revisions of the previous chapter, but also new material on choral pedagogy for geriatric singers. **Chapter 5**, is a new chapter on pedagogy for children that provides insights into training and approaches to teaching voice in primary and secondary schools. **Chapter 6**, is a new chapter about the importance of studying music in general. **Chapter 7** addresses the complex and controversial ethical issues faced by singing teachers with students or prospective students who refuse to undergo medical evaluation even when that is recommended by the teacher. **Chapter 8** provides introductory information about the physics of sound. **Chapter 9**, is an exceptionally interesting chapter on Music and the Brain, and it has been updated extensively. It reviews much of what

is known currently about central development and processing of musical information; and this science should be extremely valuable in expanding the vision of voice teachers, researchers and clinicians. **Chapter 10** on clinical anatomy and physiology of the voice has been rewritten and expanded. It contains a great deal of information about laryngeal anatomy, neuroanatomy, respiratory function and other topics that, to the best of my knowledge, have not been synthesized in similar detail in a single source elsewhere. **Chapter 11**, Baken's overview of laryngeal function, has been updated with minor changes. **Chapter 12** has been revised. In this chapter, Scherer expands on the information in Baken's chapter and provides insights into many more complex aspects of laryngeal function. Sundberg has rewritten and updated **Chapter 13** on vocal tract resonance. **Chapter 14** on voice care professionals required just minor revisions.

Beginning the section on clinical assessment of voice disorders, **Chapter 15 and 17** have been expanded to summarize information on numerous conditions not included in the last edition. **Chapter 16** on special considerations for actors has only minor changes. **Chapter 18** has been rewritten extensively. It includes not only basic concepts in laboratory evaluation, but also our most recent practices regarding instrumentation and test protocols. It also reviews techniques such as measurements of cepstral peak prominence, as well as updated references on validity and reliability of clinical voice measures. **Chapter 19**, (The Use of Instrumentation in the Singing Studio) needed only minor updates. **Chapters 20 and 21** are new. In **Chapter 20**, Echternach expands extensively on the basic information about high-speed digital imaging. **Chapter 21** provides an overview of the evolution of technology over more than a century, and its influence on the development of laryngology.

The second portion of the book contains additional information on the specific health and performance conditions that affect the voice and their assessment and treatment. **Chapter 22**, has been expanded to include new entities, and to provide more information on disorders that were covered as only separate chapters in previous editions. **Chapter 23** also has been updated and expanded extensively. It contains

a discussion of a large number of studies on the aging voice that were not addressed in previous editions. **Chapter 24** is new. While pediatric voice disorders are not discussed in detail in previous editions, this chapter adds not only differential diagnosis and treatment, but also suggestions on imaging of children, which can be challenging. **Chapter 25** on hearing loss has been updated to include a review of the last literature. **Chapter 26** on ophthalmologic care in performers required no changes. **Chapter 27** on endocrine function has been rewritten and contains the latest information on topics covered in the previous edition, as well as topics that have not been addressed in prior voice literature. **Chapter 28** is new. Thyroid surgery is extremely common and can have devastating consequences for voice professionals. This chapter reviews thyroid disorders and their many potential adverse effects. **Chapter 29** also is new and provides the most current information on the vocal effects of birth control medications. **Chapter 30** on breast cancer has been revised to include the latest information on surgical and adjunctive therapy and the implications of breast cancer treatment on singing performance. **Chapter 31** is a new chapter on autoimmune disorders and their affects on the voice. **Chapter 32** also has been rewritten extensively. In addition to covering various aspects of psychological assessment and treatment, it integrates information on the role of psychological professionals and others involved in management of voice patients. **Chapter 33** (Allergy) and **Chapter 34** (Respiratory Dysfunction) required only moderate revisions to bring them up to date.

Chapter 35 contains substantial new information on topics such as World Trade Center Syndrome and laryngeal effects of asbestos exposure. **Chapters 36** (Pyrotechnics in the Entertainment Industry), **37** (Artificial Fogs and Smokes), **38** (Infectious and Inflammatory Disorders of the Larynx), and **39** (Pharyngitis) all contain substantial new information and the most recent references. **Chapter 39** (Pharyngitis) remains a separate chapter because of the importance of the complex issue of “sore throat” in professional voice users. It is included to review current practice and to serve as a reminder that pharyngitis still can be a serious, even life-threatening condition. **Chapter 40** on sleep science and the importance of sleep in vocal performers has been rewritten almost completely by different authors and provides valuable insights unfamiliar to most otolaryngologists but extremely important to performers, especially those who travel extensively. **Chapter 41** on nutrition has been largely rewritten and summarizes important recent changes in criteria and strategy, reflecting developments in

nutritional science over the last decade. **Chapter 42** includes extensive new information on laryngopharyngeal reflux, diagnosis, treatment, and research. It cites almost 600 references including literature written since publication of the last edition, as well as classic literature that was written previously. **Chapter 43** (Seating Problems and Vocalists) has only minor changes. **Chapter 44** on bodily injuries and their effects on the voice has been revised slightly, but **Chapter 45** on performing arts-medicine has some particularly important additions. It includes a brief discussion on visual arts hazards (painting, sculpting, etc) and their implications for voice performance. **Chapter 46** is a new discussion of respiratory behavior and vocal tract issues in wind instrumentalists. It addresses the facts behind the long-standing controversy about simultaneous study of voice and wind instruments. **Chapter 47** on neurological disorders also has been revised extensively and contains the latest information about many conditions. **Chapter 48** on medications and their effects on the voice has been updated and revised extensively. **Chapter 49** offers a new and practical discussion of cough and the unified airway. **Chapter 50** on medications for traveling performers has been revised to delete medications no longer are used frequently and add various medications and drug classes that were not included in previous editions.

The section on voice therapy and treatment begins with **Chapter 51**, Introduction to Treating Voice Abuse, and **Chapter 52**, Speech-Language Pathology and the Professional Voice User are unchanged. **Chapter 53** on voice therapy has been rewritten extensively to include substantially more detail regarding specific therapeutic techniques that were not included in the previous editions, highlighting our current practices. **Chapter 54** on voice rest has been revised to include additional information published on this controversial topic since the last edition. Only minor changes were necessary in **Chapter 55**, Increasing Vocal Effectiveness.

Chapter 56 on the singing voice specialist has been rewritten extensively to include the most current techniques for management of the singing voice, for using singing techniques to help nonsingers, and to reflect our latest beliefs and practices, as well as the most recent information from the evolving literature in this field. **Chapter 57**, The Role of the Acting-Voice Trainer on the Medical Care of Professional Voice Users needed only minor changes. **Chapter 58** on exercise physiology has been rewritten completely by new authors and includes the most recent concepts and literature on this topic. Understanding exercise physiology is critical to understanding voice train-

ing and rehabilitation. **Chapter 59** reviews important information on postural analysis, a subject more familiar to other medical specialties (such as physiatry) than to otolaryngology and speech-language pathology, but one that is important to voice care and pedagogy.

In educational settings, it is the author's hope that the third edition of *Vocal Health and Pedagogy*, will be used in conjunction with *Professional Voice: The Science and Art of Clinical Care, Fourth Edition*. Ideally, the longer book should be available as a library reference; and I believe that it would be valuable to anyone teaching courses in which the third edition of *Vocal Health and Pedagogy* is used as a student text.

The fourth edition of *Professional Voice: The Science and Art of Clinical Care* also should be useful as a reference for teachers or performers who develop voice problems and seek more extensive information.

Every effort has been made to maintain style and continuity of the book throughout. Although the interdisciplinary expertise of numerous authors has been invaluable in the preparation of this text, contributions have been edited carefully where necessary to maintain consistency of linguistic style and complexity; and I have written or co-authored 39 of the 59 chapters. All of us who have been involved with the preparation of this book hope that readers will find it not only informative but also enjoyable to read.

—Robert T. Sataloff, MD, DMA

Acknowledgments to the Third Edition

I remain indebted to the many friends and colleagues acknowledged in the first and second editions of this book. As always, special thoughts and thanks go to the late Wilbur James Gould whose vision and gentle leadership formed the foundation on which so many of us have continued to build, and to the late Hans von Leden.

I am especially indebted to the many distinguished colleagues who have contributed to this edition. Those who had contributed to previous editions worked diligently to revise and update their chapters. Those who had not contributed to previous editions have added insights and expertise that have made it possible to realize my vision of what I thought this book should be.

As always, I am indebted to the National Association of Teachers of Singing for permission to use material freely from my "Laryngoscope" articles which appear in the *Journal of Singing* (formerly the *NATS Journal*), and to Vendome for permission to republish articles and color pictures from my monthly "clinic" in *Ear, Nose, and Throat Journal*. I am also grateful to John Rubin and Gwen Korovin and to Plural Publishing for permission to republish a few chapters from our book (Rubin JR, Sataloff RT, Korovin G. *Diagnosis and Treatment of Voice Disorders*, 4th ed., Plural Publishing, Inc; San Diego, CA, 2015). In addition, I am indebted for permission to republish material from *Choral Pedagogy*, 3rd ed. (Smith B, Sataloff RT. Plural Publishing Inc, San Diego, CA; 2013), *The Performer's Voice* (Benninger MS, Murry T, and Johns MM, Plu-

ral Publishing, Inc, San Diego, CA, 2016), *Sataloff's Comprehensive Textbook of Otolaryngology and Head and Neck Surgery* (Jaypee, New Delhi, 2016), and Sataloff RT, Brandfonbrener A, Lederman R, *Performing Arts Medicine*, 3rd edition (Science and Medicine, Narberth, Pennsylvania, 2010).

Lastly, as always, I cannot express sufficient thanks to Mary J. Hawkshaw, RN, BSN, CORLN, for her tireless editorial assistance, proofreading, and scholarly contributions. I am also indebted to Christina Chenes for her painstaking preparation of the manuscript and for the many errors she found and corrected, and to my associates, Karen Lyons, MD, Amanda Hu, MD, Robert Wolfson, MD, and Frank Marlowe, MD, and to my laryngology fellows. Without their collaboration, excellent patient care, and tolerance of my many academic distractions and absences, writing would be much more difficult. I am also indebted to Ridley Chauvin for his excellent suggestions to improve the content and order of this book to make it more convenient for pedagogy classes. I remain forever grateful to my father and partner Joseph Sataloff, MD, D.Sc., who taught me to write and edit, and who encouraged me to write my first papers and book, and mentored me throughout our years of practice together, as well as to my other primary mentors in training, Drs. Walter Work, Charles Krause and Malcolm Graham. My greatest gratitude goes to my wife Dahlia M. Sataloff, MD, FACS, and sons Ben and John who patiently allow me to spend so many of my evenings, weekends, and vacations writing.

About the Author



Robert Thayer Sataloff, MD, DMA, FACS, is Professor and Chairman, Department of Otolaryngology-Head and Neck Surgery and Senior Associate Dean for Clinical Academic Specialties, Drexel University College of Medicine. He is also Adjunct Professor in the departments of Otolaryngology-Head and Neck Surgery at Thomas Jefferson University and the University of Pennsylvania, as well as Adjunct Clinical Professor at Temple University and the Philadelphia College of Osteopathic Medicine; and he is on the faculty of the Academy of Vocal Arts. He served for nearly four decades as Conductor of the Thomas Jefferson University Choir. Dr. Sataloff is also a professional singer and singing teacher. He holds an undergraduate degree from Haverford College in Music Theory and Composition; graduated from Jefferson Medical College, Thomas Jefferson University; received a Doctor of Musical Arts in Voice Performance from Combs College of Music; and he completed Residency in Otolaryngology-Head and Neck Surgery and a Fellowship in Otology, Neurotology and Skull Base Surgery at the University of Michigan. Dr. Sataloff is Chairman of the Boards of Directors of the Voice Foundation and of the American Institute for Voice and Ear Research. In addition to directing all aspects of these two non-profit corporations, he has led other non-profit and for-profit enterprises. He

has been Chairman and Chief Executive of a multi-physician medical practice for over 30 years; and he served as Vice President of Hearing Conservation Noise Control, Inc. from 1981 until the time of its sale in 2003. He has also served as Chairman of the Board of Governors of Graduate Hospital; President of the American Laryngological Association, the International Association of Phonosurgery, and the Pennsylvania Academy of Otolaryngology-Head and Neck Surgery; and in numerous other leadership positions. Dr. Sataloff is Editor-in-Chief of the *Journal of Voice*; Editor-in-Chief of *Ear, Nose and Throat Journal*; Associate Editor of the *Journal of Singing* and on the editorial boards of numerous otolaryngology journals. He has written approximately 1,000 publications, including 59 books, and has been awarded more than \$5 million in research funding. His medical practice is limited to care of the professional voice and otology/neurotology/skull base surgery. Dr. Sataloff has developed numerous novel surgical procedures including total temporal bone resection for formerly untreatable skull base malignancy, laryngeal microflap and mini-microflap procedures, vocal fold lipoinjection, vocal fold lipoimplantation, and others. He has invented more than 100 laryngeal microsurgical instruments produced by Microfrance and Integra Medical, ossicular replacement prostheses

produced by Grace Medical, and novel laryngeal prostheses with Boston Medical. Dr. Sataloff is recognized as one of the founders of the field of voice, having written the first modern comprehensive article on care of singers, and the first chapter and book on care of the professional voice, as well as having influenced the evolution of the field through his own efforts and through the Voice Foundation for nearly 4 decades. He has been involved extensively throughout his career in education, including development of new curricula for graduate education. Dr. Sataloff has been instrumental in training not only residents, but also fellows and visiting laryngologists from North America, South America, Europe, Asia and Australia. His fellows have established voice centers throughout the United States, in Turkey, Singapore, Brazil, and elsewhere. He also is active in training nurses, speech language pathologists, singing teachers, and others involved in collaborative arts medicine care, pedagogy and performance education. Dr. Sataloff has been recognized by Best Doctors in America (Woodward White Athens) every year since 1992, Philadelphia Magazine since 1997, and Castle Connolly's "America's Top Doctors" since 2002. Dr. Sataloff's books include:

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To Dahlia, Ben and John Sataloff, my patient and long suffering family who allow me the time to write and to Mary J. Hawkshaw, my dear friend and invaluable collaborator and to my fellows who have given me so much inspiration and pride.

Introduction

Robert Thayer Sataloff

The human voice is extraordinary. It is capable of conveying not only complex thought, but also subtle emotion. In an instant, it can communicate the terror of a scream or the beauty of a song. As appreciated as the uniqueness and power of the human voice have been for centuries, only in the last few decades have we begun to understand how the voice works and how to care for it. The importance of the human voice in modern society cannot be overstated. It is the primary instrument through which most of us project our personalities and influence our compatriots. Professional voice users constitute an ever-increasing segment of our population, and their need for expert care has inspired new interest in understanding the function and dysfunction of the human voice. Professional voice users provide exciting challenges and special responsibilities for physicians and other health care professionals. Professional voice users include not only singers and actors, but also attorneys, politicians, clergy, educators (including some physicians), telephone receptionists, and others. Although they span a broad range of vocal sophistication and voice needs, they share a dependence on vocal endurance and quality for their livelihoods. However, the vocal needs of performing artists are especially great. In this book, we emphasize the problems of professional actors and especially singers, because they are the Olympic athletes of the voice world. Their extreme anatomic, physiologic, and therapeutic demands tax our clinical and research skills; but what we learn from them is applicable to the care of all voice patients. In most cases, mastery of the science and art of caring for professional singers provides the physician with sufficient expertise to treat other professional voice users as well, so long as the physician takes the trouble to really understand

the special needs and problems associated with various voice-dependent professions.

Voice problems may arise from laryngeal or systemic disease, trauma, or improper treatment. The consequences of voice dysfunction may be devastating; if permanent (or even temporary) vocal problems result from suboptimal medical care, they may result in substantial claims for damages. Possibly spurred by the striking increase in litigation, but largely to provide good medical care for its own sake, a great many physicians have recently turned their attention to professional voice care. Interdisciplinary research has resulted in new understanding and technology that have improved the standard of practice of laryngologists, speech-language pathologists, singing teachers, and acting-voice trainers. It is no longer sufficient for a physician to glance at a singer's vocal folds with a laryngeal mirror and continuously light and declare, "Your cords are fine. It must be the way you sing." Similarly, it is no longer sufficient to say, "The voice sounds bad" or "The voice sounds better," anymore than we would tolerate such vagueness in describing hearing.

Although physicians frequently are called on to care for singers and other voice professionals, most doctors still have little or no training in sophisticated analysis and treatment of subtle problems of the voice. Voice disorders are complex. Initially, voice complaints may seem vague and subjective, especially to health care professionals unfamiliar with the jargon of singers and actors. However, accurate diagnosis and rational treatment may be achieved through systematic inquiry based on understanding of the anatomy, physiology, psychology, and psychoacoustics of voice production. More thorough understanding of voice is valuable not only in caring

for voice problems themselves, but also in providing good medical care by recognizing systemic diseases that present with laryngeal manifestations. Just as otologists routinely diagnose diabetes and hypothyroidism that cause dizziness or fluctuating hearing loss, laryngologists should be alert to xerophonia as a sign of diabetes, muffling of the voice from hypothyroidism, fatigue from myasthenia gravis, and many other similar problems. Hypochondriasis is rare among serious singers and most other voice professionals. In general, failure to establish a diagnosis in a professional vocalist with a voice complaint is due to lack of expertise on the part of the physician rather than an imaginary complaint on the part of the singer or actor.

History

Fascination with the human voice has prompted study for centuries, as reviewed in Dr. Hans von Leden's classic chapter, "A Cultural History of the Larynx and Voice," in this book. A brief overview helps put the evolution of voice medicine, and modern developments in voice care, into perspective. In *Corpus Hippocraticum*, Hippocrates in the fifth century BC provided some of the earliest medical speculation on the workings of the voice, recognizing the importance of the lungs, trachea, lips, and tongue in phonation. Aristotle expanded knowledge on the scientific workings of the voice and commented on the close relationship between the voice and the soul, recognizing its importance in emotional expression. Claudius Galen, who practiced from AD 131 to 201, is hailed as the founder of laryngology and voice science. He wrote an essay on the human voice (among his over 300 books) that is frequently referenced but has, unfortunately, been lost. He recognized the workings of the voice, described the larynx, recognized the importance of the brain in controlling phonation, and, for the first time, distinguished between speech and voice. Galen's work went virtually unchallenged for more than 15 centuries, and some of it is still regarded as correct.

Major advancement did not come until the Renaissance and the writings of Leonardo da Vinci, particularly *Quaderni D'Anatomia* in 1500. Additional important Renaissance writers who advanced knowledge of the voice included Andreas Vesalius, Bartolomeus Eustachius, and Fabricius ab Aquapendente. Fabricius wrote three books on the larynx, including *De Larynge Vocis Instrumento*. Similar important advances occurred in the east, particularly in the ninth century when Rhazes the Experi-

enced, in Baghdad, described disorders of the voice and hoarseness and recommended respiratory and voice training. There are also excellent descriptions of voice production and disorders in the *Quanun*, written by Avicenna the Persian. The *Quanun* was a standard medical textbook for more than 500 years. Major additional advances occurred in the 18th century through the efforts of Giovanni Morgagni, who first related dysphonia to abnormalities in the larynx. Also in the 18th century, Antoine Ferrein described physiological experiments on animal and human cadaver larynges and coined the term *vocal cords*, comparing the vocal folds to the strings of an instrument. Albrecht von Haller described the anatomy of vocal resonance. Later, Johannes Müller in Germany described the mechanisms of vocal fold vibration. In the 19th century, Hermann von Helmholtz essentially started the experimental science of acoustics with experiments that are still considered valid. All of the scientists mentioned above laid the foundation for the close liaison that has existed between physicians and singers.

However, the clear and widely recognized beginning of arts-medicine in the voice world dates from the time of Manuel García, who was born in 1805. García was a world-famous opera singer while in his teens. Although he was the son of an acclaimed singer and director, his probably faulty technique and extensive operative singing impaired his voice sufficiently to cause him to retire while still in his 20s. Thereafter, he became a thoughtful, effective, and famous teacher and was made Professor of Singing at the Conservatoire de Paris at the age of 30. In 1854, García bought a dental mirror and invented the technique of indirect laryngoscopy using the sun as his light source. The laryngeal mirror is still the basic tool for visualizing vocal folds and is used daily by otolaryngologists. García observed larynges closely with his new tool and presented his findings before the Royal Society of Medicine in 1855. He was considered the greatest singing teacher of his age; on his 100th birthday in 1905, he was honored by physicians, music teachers, and scientists from all over the world.¹ Voice medicine continued to develop slowly throughout the first seven decades of the 20th century.

The development of modern voice medicine and surgery may be traced to Hirano's description of the anatomy of the vibratory margin of the vocal fold in 1975, first published in English in 1977.² Hirano's observations led to our understanding of the layered structure of the vocal fold and to the realization that we need also to conceptualize vocal fold pathology and vocal fold surgery in layers. This paradigm evolved simultaneously with additional scientific

discoveries and voice laboratory instrumentation that permitted more accurate assessment of voice function and treatment outcome.

In the past four decades, increasing interest and new technology have generated unprecedented activity within a number of disciplines. Since 1972, laryngologists, voice scientists, physicists, computer scientists, speech-language pathologists, singing teachers, acting teachers, voice coaches, singers, actors, and other professionals have met at the Voice Foundation's week-long annual Symposium on Care of the Professional Voice, started by Dr. Wilbur James Gould. At this unique meeting, formerly held at the Juilliard School of Music and now located in Philadelphia, experts have gathered to report their research and share their ideas. The resultant interdisciplinary understanding and cooperation have produced great advances and hold even greater promise for future understanding. These activities have rendered care of the professional voice the most advanced discipline within the new specialty of arts medicine. They have also inspired numerous successful interdisciplinary publications, including the *Journal of Voice*. This important journal abandons traditional specialty boundaries and brings together in one peer-reviewed journal, with international distribution, articles of high quality on all subjects relating to the voice.

In many ways, the status of voice care is still analogous to that of otology 40 years ago. Until recently, voice evaluation was reminiscent of ear examinations with a head mirror instead of a microscope or whispered voice tests instead of audiograms. In many places, it still is. Fortunately, expert research has led to greater understanding of the voice and development of instrumentation for sophisticated assessment and quantitative analysis to facilitate clinical management and research. Although efforts have focused largely on professional singers and actors, the knowledge they have accrued has advanced our understanding of voice in general and modified substantially the state of the art in clinical care of all persons with voice disorders. Still, the field is new. The first extensive article in the English literature intended to teach clinicians how to approach professional singers was not published until 1981,¹ and the first major American general textbook of otolaryngology containing a chapter on care of the professional voice was not published until 1986.³ The first modern comprehensive textbook in English on medical care of the professional voice was not published until 1991 (the first edition of this text).⁴ However, it should be remembered that, although these contributions in English helped signal the arrival and acceptance of voice as a subspecialty, there were noteworthy pre-

decessors who discussed voice; some even touched on the type of professional voice user.⁵⁻¹¹

The importance of interdisciplinary voice care to the evolution of modern voice care cannot be overemphasized. Although there were a few scattered collaborations in the 19th and 20th centuries, the first formal, academically based interdisciplinary voice clinic in the United States was established by Drs. Hans von Leden and Paul Moore at Northwestern University Medical School in 1954. These pioneers, a laryngologist and a speech pathologist, established a clinic in which they saw patients simultaneously, sharing insights and optimizing patient care. They continued this approach separately after von Leden moved to Los Angeles and Moore moved to the University of Florida in Gainesville, although it was not always possible for them to practice as closely with interdisciplinary colleagues "under one roof." This concept was expanded in Philadelphia in 1981 when the author (RTS) hired a singing teacher and a speech-language pathologist as full-time employees of his medical practice. His expanded interdisciplinary voice team now includes three singing teachers, three speech-language pathologists, a psychologist, a voice scientist, an acting-voice trainer, and two otolaryngologic nurse-clinicians. It also includes the very close collaboration of arts-medicine colleagues located nearby, including a pulmonologist, psychiatrist, neurologist, gastroenterologist, endocrinologist, ophthalmologist, and others. He anticipates further expansion of this interdisciplinary approach, because it has proven so valuable in advancing patient care and stimulating creative research.

In the past several years, many new centers and academic training programs have acquired voice laboratories and begun practicing and teaching modern, advanced voice care, but more time will be required before state-of-the-art care is available in most geographical areas.

At present, new understanding of special aspects of the history and physical examination of professional voice users has been supplemented by technological advances through voice analysis, which are readily available to interested clinicians. Flexible fiberoptic laryngoscopy has been indispensable. The development and refinement of laryngeal stroboscopy are singularly important advancements. Stroboscopic evaluation of vocal fold behavior in slow motion allows diagnoses that are simply missed without it. High-speed video and videokymography are promising newer techniques that may improve our ability to assess the mucosal wave. Spectrography, electroglottography, electromyography, airflow analysis, and other techniques have also

enhanced our ability to analyze and treat voice disorders reliably.

When physicians encounter a patient with a voice problem, they approach the problem using a combination of art (style, empathy, intuition) and science (objective analysis based on facts). Both components are important, and no physician, speech-language pathologist, singing teacher, or acting voice teacher can be considered excellent if she or he abandons the art of practice in favor of dispassionate scientific analysis alone. However, care is at least as bad when we are forced to depend on intuition almost exclusively, because of insufficient knowledge. This is popularly called “winging it,” and it is a fair description of most voice care prior to the last two decades. Fortunately, science has provided us with an understanding that the voice consists of at least three principal components (power source, oscillator, resonator), that each component is designed to control specific aspects of voice production, and that there are ways to identify and quantify the performance of each component. This information provides voice care professionals with a framework and language with which we can think about voice problems. This has permitted us to add not only scientific fact, but also scientific thought to voice care.

The knowledge acquired through medical and basic science research has advanced not only clinical care but also the teaching of voice. Modern singing, acting, and speech teachers have acquired new scientific understanding of the voice and use their new knowledge to augment and refine their traditional approaches to voice training. This should lead to consistently healthier and more efficient voice training. There are many other fascinating potential implications as well. For example, to sing correctly is essentially an athletic endeavor. In this century, most athletic records have been broken. Often this has been the result of technological advancements, such as computer analysis of a runner’s form using high-speed photography or stroboscopy. Through these and other methods, the marathon, pole vault, high jump, and swimming records of 50 years ago are barely qualifying marks for today’s high school students. Similar principles have just begun to be applied to the proper training of the voice. It is tempting to speculate about the results. Perhaps, as in other athletic pursuits, we shall find that the healthy limits of human vocal potential are far greater than we think.

Major advances in physician education have had substantial impact on patient care nationally and internationally. Development and voluntary standardization of content of laryngeal fellowships have

been particularly important.¹² Fellowships are producing well-trained laryngologists who understand not only voice, but also other aspects of the field, and they are entering academic medicine in the United States and elsewhere so that they can pass on state-of-the-art knowledge to the next generation of otolaryngologists. Substantial strides also have been made in public awareness, particularly through international celebrations of World Voice Day, and summarized by Sataloff.¹³ Laryngologists also are learning how to build a professional voice practice so that voice professionals can have access to centers of excellence in voice care.¹⁴

Discretion

The excitement and glamour associated with caring for a famous performer naturally tempt the physician to talk about his or her distinguished patient. However, this tendency must be tempered. It is not always in a singer’s or actor’s best professional interest to have it known that he or she has consulted a laryngologist, particularly for treatment of a significant vocal problem. Famous singers and actors are ethically and legally entitled to the same confidentiality we assure for our other patients.

Notation

In speech-language pathology, voice science, and academic music, sounds are designated using the International Phonetic Alphabet (IPA) (Appendix I). This is standard notation and will be used throughout this book. Readers should familiarize themselves with IPA notation and use it, because its meaning is well defined and widely understood.

Conclusion

For centuries, most physicians functioned in relative isolation, having only limited daily interaction and intellectual discourse with colleagues outside of medicine.¹⁵ During the last 4 decades, that model has changed. Laryngologists not only *collaborate* with voice scientists, speech-language pathologists, singing and acting teachers, physicists, chaoticians, molecular geneticists, computer scientists, neurologists, pulmonologists, pathologists, endocrinologists, pharmacologists, psychiatrists, and other professionals, but we also have incorporated information,

thought processes, and problem-solving strategies from these various disciplines into our clinical thinking, research, and educational programs. This fundamental change has broadened our vision and provided us with new intellectual tools that we use daily and that underlie dramatic improvements in knowledge and patient care. In laryngology fellowships and a growing number of residencies, programs are evolving to provide our trainees with not only new information but also with the ability to think more broadly and collaboratively, not just within the new, expanded paradigms, but even further “outside the box.”

Great progress has been made toward understanding the function, dysfunction, and treatment of the human voice. Because so many of the advances have involved collaboration among physicians, voice scientists, speech-language pathologists, singing and acting teachers, singers, and actors, they have been applied practically much more quickly than usual. The dramatic progress that has occurred in the last 4 decades has resulted in great diagnostic and therapeutic benefits for all patients with voice complaints and in the emergence of a new medical specialty in voice. Scientific advances and collaboration have given us not merely new tools, but rather a whole new approach to the voice. No longer must we depend on intuition and mysticism in the medical office or voice studio. We now have the knowledge and vocabulary necessary for accurate analysis of voice problems and systematic, logical solutions. Thus, we finally have enough information to include effectively in our voice armamentarium the most important missing component—rational thought. It has raised the standard of voice care and training forever.

We have much reason to be proud of the recent advances in the state of the art in laryngology, although it is somewhat disappointing to note the paucity of good, prospective, controlled studies in laryngology that might confirm or refute our growing body of belief which still is grounded largely in papers that do not meet the highest standards of evidence-based research.¹⁵ We know vastly more than we did 40 years ago about diagnosis, nonsurgical and surgical treatment, quantification of voice function,

outcomes assessment, important unanswered questions, and how to go about answering those questions. Our future promises continued advances in all of those areas and more.

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