CLINICAL VOICE PATHOLOGY

THEORY AND MANAGEMENT

Seventh Edition

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Preface

With each new edition of *Clinical Voice Pathology: Theory and Management* comes societal, professional, and educational change; this seventh edition is no exception. This is a clinical textbook meant to lay the groundwork for speech-language pathology students to eventually become competent providers for the care and management of patients with voice disorders. With the rapid change in technology, our profession evolves, necessary skills are modified and expanded, and research demonstrates new and better methods for evaluation and treatment. Technology has also impacted how students acquire and retain information so that our teaching approaches also must be modified. To meet these changes, the seventh edition of this text has also been modified to take advantage of technology that will assist both speech-language pathology students and their instructors to build the foundational knowledge necessary to evaluate and treat voice disorders. This knowledge includes the history and common causes of voice disorders, anatomy and physiology of voice production, pathologies of the vocal mechanism, and an extensive array of evaluation and management approaches.

Changes made to this edition continue to focus on enhancements to instruction and learning, including use of "Call-Out" boxes throughout the text to highlight cases, encourage additional thought, and suggest additional readings; full-color figures and illustrations to enhance learning and understanding of the material; and a companion website with additional content including extensive audio and video examples of cases, laryngeal pathologies, treatment demonstrations/tutorials, and instructional PowerPoint lectures. In addition to updated references throughout the text to reflect the current state of clinical research in evaluation and treatment of voice disorders, we introduce two new chapters describing the speech-language pathologist's roles and responsibilities related to assessment and management of (a) individuals with upper airway disorders (including chronic refractory cough as well as inducible laryngeal obstruction) and (b) individuals undergoing gender-affirming voice care. In both chapters we provide an in-depth survey of each topic.

The advances in our field in the past 40 years have been extraordinary. However, when one studies the history of our specialty, it is remarkable how much of our past remains in terms of assessment and treatment. As an example, with all the available technology to aid in voice evaluation, we would submit that the skilled patient interview remains the most important part of the voice assessment. In the same vein, many of the therapy techniques we currently use have their foundations in skills that were practiced centuries ago to enhance the singing and speaking

voices. The advances in our knowledge have significantly enhanced the diagnostic process and have helped confirm whether our chosen treatments are truly effective.

The authors of this text have been privileged to provide clinical services to those with voice disorders and to research many aspects of voice production for many years. While we have had the opportunity to work in interdisciplinary clinical voice centers, side by side with our laryngology partners, we fully understand that voice therapy is needed and provided in practically every setting in which speech-language pathologists work. This text is designed to help prepare all clinicians, not only those who specialize in the area of voice, to evaluate and treat voice disorders. This unique and eclectic population of patients encompasses all ages across the life span and represents etiologies arising from medical, environmental, social, psychological, and occupational threats to vocal health. Our patients may be typical voice users, occupational voice users, elite vocal performers, individuals with head and neck cancer, and others who suffer with upper airway symptoms. Each patient provides us with a unique diagnostic dilemma: How do we best return the voice to optimal condition?

This text is organized to systematically build the knowledge base and clinical skills necessary to successfully answer this question. We seek to organize, explain, and illustrate the comprehensive hierarchy of knowledge necessary to manage the many types of voice disorders. **Chapter 1** begins with an entertaining history of voice disorders, from their ancient foundations to the present. This information clarifies the role of speech-language pathologists in the care of voice-disordered patients and introduces the interdisciplinary background that has permeated our history of successful voice therapy.

A progressive development of essential clinical knowledge areas begins with **Chapter 2**, the anatomy and physiology of voice production. Understanding the structure and function of the laryngeal mechanism is essential for evaluating phonatory function, examining the larynx and vocal folds, recognizing the impact of abnormal changes or adaptations on voice production, and sharing information with our physician partners in care. Using enhanced illustrations, this seventh edition updates the descriptions of the three subsystems of voice production—respiration, phonation, and resonance—and expands the discussion of vocal fold histology and DNA microarray gene expression analysis.

Chapter 3 provides a thorough update on the common etiologies of voice disorders including behavioral, medical, and personality-related etiologies. Common factors associated with the cause and maintenance of voice disorders are discussed to understand best options for treatment planning.

Chapter 4 presents the pathologies of the laryngeal mechanism, organized according to the *Classification Manual for Voice Disorders–I* developed by Special Interest Group 3 (Voice and Voice Disorders) of the American Speech-Language-Hearing Association (2006). The pathologies are presented in eight major groups: (1) structural pathologies; (2) inflammatory conditions; (3) trauma or injury; (4) systemic conditions affecting voice; (5) aerodigestive conditions affective voice; (6) psychiatric or psychological disorders affecting voice; (7) neurologic voice disorders; and (8) other

disorders of voice. Most of the pathologies are illustrated with color plates.

Chapters 5 and 6 discuss the objectives and procedures of a systematic diagnostic voice evaluation. Chapter 5 introduces traditional evaluation techniques, including the patient interview, auditory–perceptual judgments, patient self-assessment, determining the cause(s) and maintaining factor(s) of the voice disorder, stimulability testing, and educating the patient about these findings to establish a collaborative management plan based on these clinical data. Chapter 6 provides a state-of-the-art overview of the instrumental measures that compose a comprehensive voice assessment, including the scientific principles that underlie their development, application, and interpretation. In addition to standard measures of acoustics, aerodynamics, electromyography, and stroboscopy, this edition explains the utility of high-speed digital imaging and videokymography tools. The appendices include instrumental measurement norms and a helpful glossary of terms.

Knowledge of anatomy and physiology, pathologies, etiologies, and the diagnostic process have prepared the reader for **Chapter 7**, which explores an array of voice therapy approaches following the orientations of hygienic, symptomatic, psychogenic, physiologic, and eclectic treatments. Using frequent patient cases to illustrate major insights about voice treatment that we have each gathered from our 35-plus years of clinical experience, we orient the reader to the theories, selection criteria, and clinical methods for specific voice management principles. This treatment framework is appropriate for common yet diverse voice complaints due to a variety of laryngeal pathologies and vocal dysfunctions. Finally, we highlight the current clinical evidence that supports popular treatments used in voice therapy and introduce the Rehabilitation Treatment Specification System–Voice, an important tool for delineating ingredients, targets, and mechanisms of action ostensibly underlying what we do as voice clinicians.

Because of the exceptional concerns of voice performers, **Chapter 8** introduces the factors that influence clinical management approaches for this artistic population, such as personalities, temperament, performance routines and schedules, and other special considerations needed for their care and treatment. The chapter defines the roles of the expanded interdisciplinary team and identifies the affiliate organizations that represent and support voice performers. In addition to traditional voice therapy considerations, the chapter discusses nontraditional alternative treatments that are popular with this population.

Chapter 9, Rehabilitation of the Laryngectomized Patient, serves as a stand-alone manual on the management of this special patient population. This chapter reflects the current "best practice" in voice rehabilitation or restoration in head and neck cancer patients. By outlining the complementary roles of the interdisciplinary treatment team, we understand the multiple management goals: cure the disease, select optimal communication methods, ensure safe swallowing, and address any associated physical, social, and emotional changes that affect each patient. The chapter also contains images of the latest communication and airway management devices currently on the market.

Chapter 10, written by Tammy Wigginton and Mark Finfrock, reflects our experience that many colleagues who

teach voice and swallowing disorders are often tasked with also teaching information related to the speech-language pathologist's role in assessing and managing tracheostomy and ventilator dependent patients. With the knowledge that there are limited teaching resources related to this area for our field, these authors, a speech-language pathologist and a respiratory therapist, respectively, provide an excellent chapter that surveys the basics of the artificial airway and the dynamics of mechanical ventilation as applied to the practice of speech-language pathology.

New to this seventh edition are **Chapters 11 and 12**. Both reflect the expanding roles and responsibilities of speech-language pathologists in upper airway disorders and gender-affirming voice care. **Chapter 11** provides a thorough and contemporary evidence-based review of the assessment and treatment of three upper airway conditions that speech-language pathologists often encounter: chronic refractory cough, inducible laryngeal obstruction (formerly known as paradoxical vocal fold motion), and exercise-induced laryngeal obstruction. In all three conditions, symptoms are localized to the larynx. Yet, when examined, the larynx and surrounding structures are usually grossly normal. Given the frequency, comorbidity, and laryngeal focus of these conditions, it is imperative that clinicians understand how to assess and treat them. In Chapter 11, we provide the foundation for this understanding.

Chapter 12, is an extremely important new addition to our book. It is written by Brett Myers, PhD, CCC-SLP (he/him), Associate Professor and Director of Clinical Education in the Department of Communication Sciences and Disorders at the University of Utah. Dr. Myers manages the Gender-Affirming Voice Clinic where he teaches graduate students in speech-language pathology to provide gender-affirming voice training. Dr. Myers also serves on the Transgender Health Program at University of Utah Health, an interdisciplinary collaboration providing supportive, accessible health care in a trans-affirmative environment. While other chapters in this text focus on voice and upper airway disorders and their rehabilitation, Dr. Myers' chapter addresses voice *habilitation* in the form of gender-affirming voice and communication care for transgender and gender-diverse individuals who seek services to make their voice and/or other aspects of communication congruent with their gender identity. Speech-language pathologists, often as members of an interprofessional gender-affirming care team, provide their expertise in safely modifying the voice and other aspects of communication. Dr. Myers' chapter covers considerable territory on this topic, including approaches to gender-affirming health care, the importance of voice in the perception of gender, and evidence-based methods for assessment and treatment.

Over the past four and a half decades, our chosen specialty of clinical voice pathology has expanded greatly within the field of communication disorders. Nonetheless, this seventh edition of our text retains its original purpose: *to provide students and clinicians with a strong foundation of basic voice science infused with a deep clinical understanding of the best methods for assessing and treating voice disorders*. We hope that you, the reader, will find this text clear, informative, and a worthwhile addition to your professional library.

Text development requires a team, and we are deeply indebted to our team,

Angie Singh, Rebecca Cota, and Valerie Johns, for encouraging and supporting this seventh edition, and to Lori Asbury and Jessica Bristow on the production side of the text preparation. In addition, we wish to thank our students and colleagues who have suggested ways to improve the text with each new writing. As always, we are most appreciative for the support of our families. Finally, we are greatly indebted to our patients, who have taught us so much about what is important in the care of their voices.

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1

Voice: A Historical Perspective

INTRODUCTION

Voice, articulation, and language are the major elements of human speech production. When a disorder related to any of these elements is present, the ability to communicate may be impaired. Voice is the element of speech that provides the speaker with the vibratory signal upon which speech is carried. Regarded as magical and mystical in ancient times, today the production of voice is viewed as both a powerful communication tool and an artistic medium. It serves as the melody of our speech and provides expression, feeling, intent, and mood to our daily articulated thoughts. As it is expressed artistically through the many varieties of vocal performance, voice provides great expression and joy for both the listener and the performer.

Call-Out Box 1–1

You can change the meaning or intent of a phrase by simply changing your vocal expression using vocal pitch, loudness, and inflection. Say the phrase, "My roommate is moving out at the end of the semester," as if you are happy, then sad, then disgusted. See how the manner of voice production influences the meaning of your words.

This text is concerned with the study of both normal and disordered voice production. It is meant to introduce the reader to the science of voice production, the causes of voice disorders, and the pathologies of vocal function. You will explore methods of evaluation of voice disorders and delve into the wide array of management

techniques, all of which are designed to return the pathologic voice to an improved state of equilibrium. Treating voice disorders is extremely rewarding. The vast majority of patients with vocal difficulties, who follow the prescribed treatment plans, significantly improve their voice quality in a relatively short period of time.

Definition of a Voice Disorder

The historical definition states that a voice disorder exists when a person's quality, pitch, and loudness differ from those of similar age, gender, cultural background, and geographic location.[1–4] In other words, when the perceptual properties of voice are so deviant that they draw attention to the speaker, a voice disorder may be present. We would further suggest that a voice disorder may also exist when the structure and/or function of the laryngeal mechanism no longer meet the voicing requirements established for the mechanism by the speaker. These requirements include vocal difficulties that others do not readily recognize, such as the negative effects of vocal fatigue or instability in the singing voice, but are reported to be present by the speaker.

The effects of a voice disorder depend on the voicing needs of the individual. Those with a great need for normal voice production, such as professional voice users, may be unusually concerned with the presence of even minor vocal difficulties. Those with low vocal needs may not be greatly concerned with even more severe vocal problems. Identifying the vocal needs of each patient is extremely important in successfully treating voice disorders.[5] Successful management of a voice disorder is dependent on the individual recognizing the problem and accepting the need for improvement.

Call-Out Box 1–2

List professions that you think would require a high vocal demand. List professions that would require a lesser vocal demand.

Role and Skills of the Speech-Language Pathologist

The speech-language pathologist (SLP) plays a major role in the evaluation and management of voice disorders. This role focuses on three major goals: (1) evaluation of laryngeal function using auditory and visual perceptual tasks, acoustic analysis, aerodynamic measures of vocal function, and patient self-assessment[6]; (2) identification and modification, or elimination, of the functional causes that led to the development of the voice disorder; and (3) development of a therapy plan that will remediate the voice disorder and improve voice-related function. To accomplish these goals, SLPs must have an extensive understanding and knowledge of the normal anatomy and physiology of the laryngeal mechanism, as well as knowledge of common laryngeal pathologies. They also must understand etiologic factors that lead to the development of voice disorders, as well as appropriate diagnostic techniques and skills for discovering the causes. Finally, based on this knowledge, SLPs must develop a bank of clinical management approaches for remediating the voice disorder.

SLPs have been involved in the evaluation and management of voice disorders since the beginning of the profession in the 1930s.[7,8] The advent of voice therapy was a unique blend of the knowledge that speech correctionists, as SLPs were then called, gained from training in the areas of public speaking, oral interpretation, and theater arts. This training was combined with a firm understanding in the areas of anatomy, physiology, psychology, and pathologies of the laryngeal mechanism. In more recent history, voice pathologists (SLPs who specialize in voice disorders are often called voice pathologists; both terms will be used in this text) have been required to also gain knowledge in areas such as vocal fold histology, biomechanics of laryngeal tissue, voice acoustics, aerodynamics of voice production, and visual imaging and interpretation of vocal function.[9–13] These years, during which SLPs have dealt with the remediation of voice disorders, represent only a small segment of time when compared with the total history of the evaluation and treatment of voice disorders. We begin by looking at the past as a means of gaining an understanding and appreciation of the current knowledge of clinical voice pathology.

ANCIENT HISTORY

Folklore Remedies

The earliest accounts of voice disorders, as with other medical information, were handed down orally. These accounts were mainly represented by folk remedies for various recognized disorders. Folklore remedies for disorders of the throat included rubbing liniment derived from centipedes on the neck, gargling the juice of crabs, and inhaling the ashes of a burned swallow. Plant remedies included gargles made from cabbage, garlic, nettles, pennyroyal, and sorrel. Wearing beads of various kinds, or a black silk cord around the throat, was also recommended, as was the excommunication of sore throats in the name of God.[14]

Egyptian Papyri

One of the earliest written histories of a voice disorder was presented about 1600 BC in the Edwin Smith Papyrus. One of many Egyptian papyri discovered in burial tombs, the Edwin Smith Papyrus contained early medical writings. It described 50 traumatic surgical cases, beginning with injuries to the head, and continuing down the body to the thorax. One of these cases was a detailed description of a crushing injury to the neck, which caused the loss of speech. The Egyptian writings contained a hieroglyph portraying the lungs and trachea (Figure 1–1). The larynx was not pictured because no organ for voice had yet been identified.[15]

Hindu Writings

The ancient Hindu civilization presented much medical information, including mention of diseases of the throat. The most notable information was presented in the Sanskrit-Atharva-Veda (700 BC). Among the Hindus, surgical achievements included tonsillectomy and rhinoplasty. Nose flaps became a necessity in this civilization

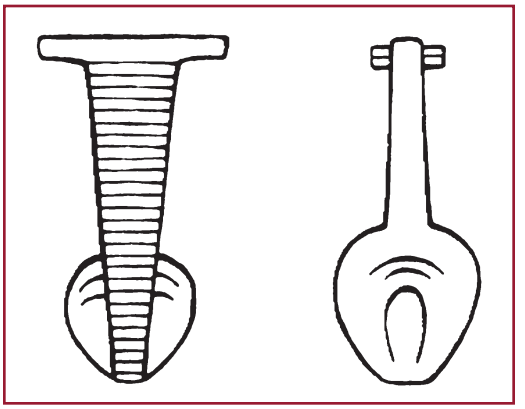

FIGURE 1–1. Egyptian hieroglyph of the trachea and lungs.

because cutting off the nose was the corporal punishment for adultery. Hindu gargles for throat disorders included oils, vinegar, honey, fruit juices, and the urine of sacred cows.[16]

Hippocrates

In the fifth century BC, Hippocrates, the "Father of Medicine," (Figure 1–2) was responsible for finally separating medicine from magic. One of Hippocrates' greatest contributions to medicine was his insistence on the value of observation. Hippocrates made many observations regarding diseases associated with the throat and voice, although he, too, failed to identify the source of voice. Several of these observations, as translated by Chadwick and Mann[17] include:

- Aphorism 58: Commotion of the brain, from any cause, is inevitably followed by loss of voice.
- Coan Prognosis 240: Aphonia is of the most serious significance if accompanied by weakness.
- Coan Prognosis 243: Aphonia during fever in the manner of that seen in seizure, associated with a quiet delirium, is fatal.
- Coan Prognosis 252: A shrill whining voice and dimness of the eyes denote a spasm.

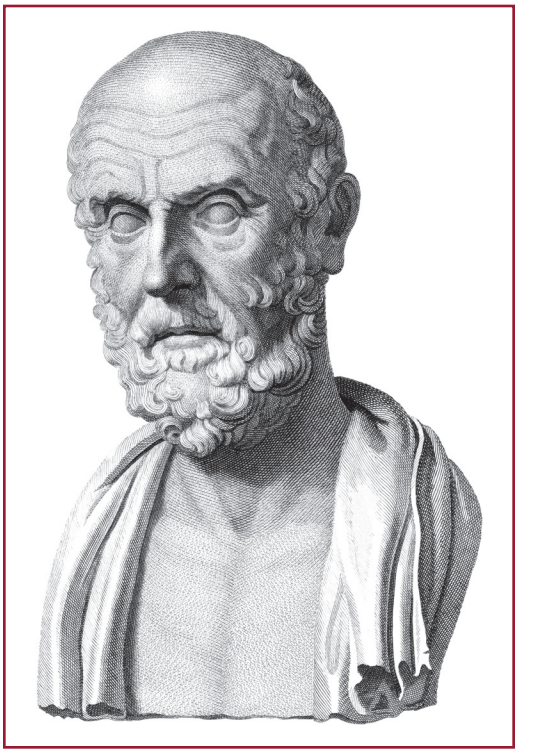

FIGURE 1–2. Hippocrates, 460–370 BC.

These examples demonstrate that Hippocrates studied symptoms more than treatments of diseases. Hippocrates was the first person to write that observation of voice quality, whether it be clear or hoarse, is one means by which a physical diagnosis may be reached.[17] Observation of voice quality remains a powerful diagnostic tool to this day.

Aristotle

Aristotle (Figure 1–3) was the first writer to refer to the larynx as the organ from which the voice emanates. In his *Historia*

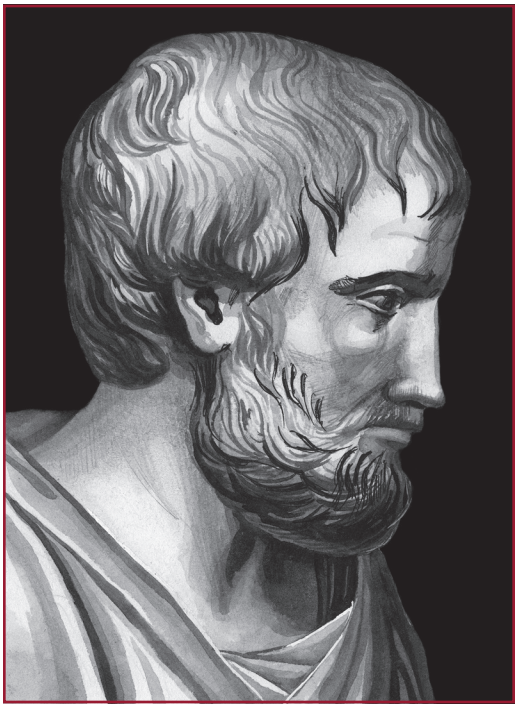

FIGURE 1–3. Aristotle, 384–322 BC.

Animalium,[18] written in the late fourth century BC, he stated that the neck was the part of the body between the face and the trunk, with the front being the larynx and the back, the gullet. He further stated that phonation and respiration took place through the larynx and the windpipe.

Claudius Galenus

Aristotle's understanding of voice production lay dormant until 5 centuries later when the first true anatomist, Claudius Galenus (Figure 1–4), was born in Asia Minor in 131 AD. Galen derived his knowledge of anatomy from the dissection of animals. He greatly advanced the knowledge of the upper air passages and the larynx and described the warming and filtering functions of the nose.

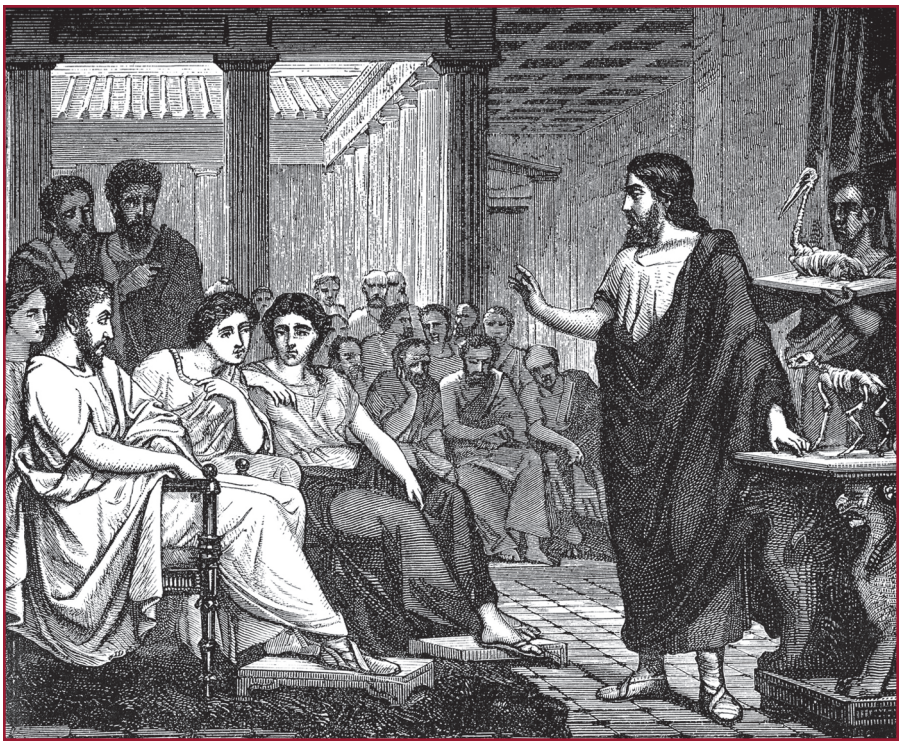

FIGURE 1–4. Claudius Galenus (Galen), 130–210 AD.

He also distinguished six pairs of intralaryngeal muscles and divided them into abductor and adductor muscles. He described the thyroid, cricoid, and arytenoid cartilages, as well as the activity of the recurrent laryngeal nerves.[14]

In experiments with pigs, Galen demonstrated that pigs would always cease making squealing sounds when the recurrent laryngeal nerve was severed. This led him to conclude that muscles move certain parts of the body on which breathing and voice depend, and that these muscle movements are dependent on nerves from the brain. Galen, therefore, proved that the larynx was the organ of voice, thus disproving that the "voice was sent forth by the heart,"[14] which was still a popular belief.

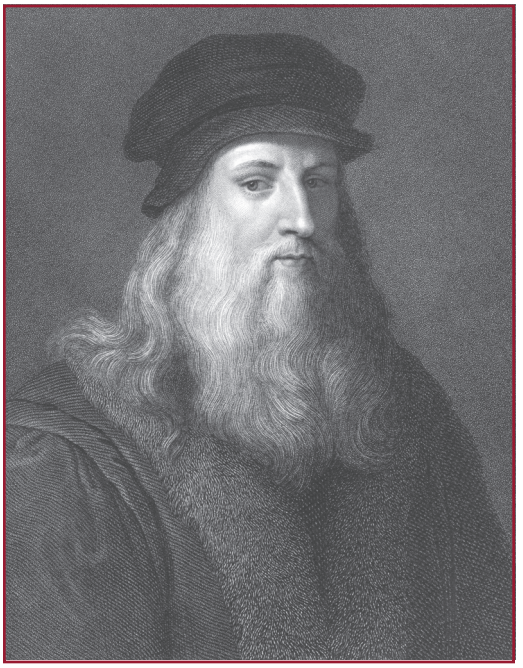

FIGURE 1–5. Leonardo da Vinci, 1452–1519.

THE RENAISSANCE

Galen did much to further medical progress, but his theories and views, which were by no means totally accurate, were blindly accepted for 1500 years as the world went through the Dark Ages. This historical period of intellectual and artistic stagnation was finally broken in the late 14th and early 15th centuries AD with the invention of the printing press, the astronomic discoveries of Copernicus and Galileo, and the discovery and exploration of the Western Hemisphere. With these and other discoveries, the world began the great growth period known as the Renaissance.

A genius of the Renaissance, the bold artist Leonardo da Vinci (1452–1519) (Figure 1–5) did not hesitate to exchange his paintbrush for a dissection scalpel to explore the human anatomy. Andreas Vesalius (1514–1564) (Figure 1–6) reformed the knowledge of anatomy. In his 1542 publication, *De Humani Corporis Fabrica*,[19] this 29-year-old anatomist and artist corrected many of Galen's age-old errors. He clarified the laryngeal anatomy and presented the function of the epiglottis. Vesalius' work was considered to be the anatomic classic of his time.[14]

During this period, Bartolomeus Eustachius (1520–1574; Figure 1–7) was one of the first anatomists to accurately describe the structure, course, and relations of the eustachian tube. More interesting were his descriptions and carvings of the anatomy of the larynx, which were not discovered until the 18th century in the Vatican Library, and are even more detailed and accurate than those of Vesalius. Fabricius, of Padua, Italy, authored the first monograph of the larynx (1600), entitled *De Visione Auditu*.[20]

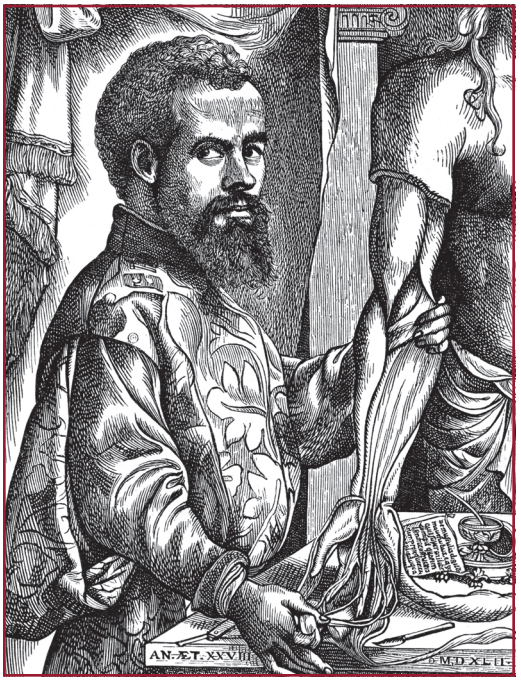

FIGURE 1–6. Andreas Vesalius, 1514–1564.

FIGURE 1–7. Bartolomeus Eustachius, 1520–1574.

In his monograph, Fabricius named the posterior cricoarytenoid muscles and described the action of the other laryngeal muscles.

THE 17TH TO 19TH CENTURIES

The discoveries of anatomy, physiology, and pathology of the laryngeal mechanism continued, highlighted by descriptions of the laryngeal ventricles by the Italian anatomist Giovanni Morgagni (1682–1771); further clarification of the purpose of the epiglottis by Francois Magendie (1783–1855) of Paris, France; the functions of the laryngeal cartilages and muscles in the production of voice by Robert Willis in Cambridge, England, in 1829; and, finally, in Frederick Ryland's (1837) publication titled *Treatise on the Disease and Injuries of the Larynx and Trachea*.[20] This important publication clearly described the diseases of the larynx (Figure 1–8) as they were understood before the use of the laryngeal mirror.

THE LARYNGEAL MIRROR

Since the time of Aristotle, many minds had considered the idea of examining the larynx in living humans. It was not until 1854, however, that a Spanish singing teacher named Manuel Garcia (1804–1906) (Figure 1–9) made the discovery that ushered in what became known as the modern era of laryngology.

Strolling through the gardens of Palais-Royal on a bright September day, Garcia observed the flashing sun