

# **A REVIEW OF VOICOLOGY FOR THE SINGING VOICE**

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DOCTOR OF MUSICAL ARTS

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by  
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## ABSTRACT

This monograph is a review of the general state of vocology as it relates to the singing voice. It provides a working resource guide for singing voice professionals. Specifically, it presents the available technology, medical applications, and educational opportunities in the field of vocology. Having a central resource such as this allows voice professionals to more easily understand the interrelated portions of their parent field (vocology) and to access and navigate the resources available to them. Furthermore, the review raises awareness of the areas requiring further development in the field and brings to light many potential opportunities for collaborations among professionals.

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## DEDICATION

To my father, an inspiration!

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## CHAPTER 1: AN OVERVIEW OF VOCOLOGY FOR THE SINGING VOICE

Vocology is a term that was developed collaboratively by Ingo Titze, PhD and George Gates, MD in 1989 and officially used in print in 1991. According to Titze:

Vocology is the science and practice of voice habilitation, with a strong emphasis on habilitation. To habilitate means to “enable,” to “equip for,” to “capacitate;” in other words, to assist in performing whatever function needs to be performed. Thus vocal habilitation is more than repairing a voice or bringing it back to a former state...rather, it is the process of strengthening and equipping the voice to meet very specific and special demands (Titze, 1996, p. 5).

Vocology as a broad field includes all aspects of the singing and speaking voice and is designed to help both professional and non-professional voice users. To fulfill the goal of voice habilitation, there must be collaboration among professionals in a wide variety of disciplines: laryngologists, voice teachers, speech-language pathologists (SLP), voice scientists and singing voice specialists (SVS).<sup>1</sup> Hence, vocology came to be from interaction among the fields of voice science, medicine, theatrical voice training, and singing voice pedagogy. Rather than an individual discipline, vocology is an umbrella science for several disciplines. For example, vocology is the parent science to the medical discipline of laryngology in the same way that audiology is a parent science to otology. The influence that the disciplines within vocology continue to have on each other has reshaped the medical and pedagogical treatment of the human voice.

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<sup>1</sup> Singing voice specialists are those professionals (either voice teachers or speech pathologists) who claim that they have gained a high level of knowledge of voice science and experience working with both injured and healthy singers. This knowledge allows them to treat injured singers. There is no current certification for singing voice specialists, therefore making an exact definition impossible. Singing voice specialists are self-declared. See Chapter Three for further discussion.

Furthermore, recent advancements in technology and medicine have allowed for even greater interdisciplinary collaboration among disciplines (Titze, 2002).

The scope of this project is to examine the current state of the field of vocology for the singing voice as it relates to technology/instrumentation, medical applications and educational opportunities. This examination is intentionally broad and the resulting guide functions as a map or overview of the field for interested parties. The guide is not totally inclusive; rather, it directs readers to resources for more in-depth research on the various aspects of the field or exposes areas of the field that require further research. At present, there is no central, up-to-date resource for singing voice vocologists to access practical information regarding singing voice vocology. Since vocologists must be prepared to train and repair voices, Titze emphasizes that they should have at their disposal “all of the tools that are available to the speech-language pathologist, the singing teacher, the acting coach, and the public speaking trainer” (Titze, 1996, p. 5). To that end, singing voice vocologists should have access to the tools that are available to the singing voice therapist (speech language pathologist or singing voice specialist), the singing pedagogue, the singing voice scientist and the laryngologist who specializes in treating singers. A review of the state of singing voice vocology brings together vital information, which is planned to be presented at conferences including The Voice Foundation Annual Symposium (June 2012) and The National Association of Teachers of Singing biannual National Conference (July 2012) and uploaded to the internet as a web-resource via the National Center for Voice and Speech. These resources will also be available to music educators, choral directors, and other professionals who work with singers.

The need for this proposed resource is reinforced by postings on the American

Speech-Language Hearing Association's Voice Special Interest Division listserv. For example, on January 13, 2011, Ellen Markus, MA, CCC-SLP, DMA posted to the listserv the following request:

Dear Colleagues - I have a graduate SLP student working with me this semester who has a BA in Voice Music Performance and is looking for a CFY position in the voice area. He knows about the position at Emory and at Henry Ford (which rotates into voice, among other areas). Does anyone know of any other positions that are open for CFY candidates (Markus, 2011)?

This posting accentuates the lack of availability of information regarding training for clinical vocologists. Ellen Markus explains in her posting that her student, a recent SLP graduate, is unsure of how to obtain further clinical training in voice as part of his clinical fellowship. To further clarify, all SLP master's graduates must complete a 36-week clinical fellowship (CFY) before obtaining certification as a speech pathologist. When looking to specialize in voice, the options for fellowships were unclear to this student, even though there were several opportunities available. Because there is no central location for information regarding vocology training, even Ellen Markus, an active voice pedagogue and SLP working as a singing voice specialist and professor at the University of North Carolina Chapel Hill Voice Center, did not know about the possible training opportunities in her field and could not find an appropriate resource to which she could direct her student.

Another posting from the same listserv illustrates a need for central resources from the perspective of an SLP who does not have a background in voice, but would like to receive training in voice. She writes:

I am a somewhat new-to-the-field-of-voice SLP. Any opinions on what the best conferences are for improving my knowledge for the assessment and treatment of VCD and MTD? Any insight would be great (Pfister, 2011).

This certified SLP is looking for help in treating vocal cord dysfunction (VCD) and muscle tension dysphonia (MTD), common voice disorders. She did not know where to turn for information on educational opportunities in the field. By having information on conferences and other training opportunities in one location, newcomers to the field of voice and vocology, like the woman who posted this question, will be able to navigate their training paths by accessing a “big picture” of the field of singing voice vocology and the opportunities available to them.

The sources used to conduct this review are varied in nature. They include: scholarly books and articles regarding vocology and related topics; internet resources, specifically those dedicated to the description of medical and educational institutions and their services regarding vocal health and pedagogy; and personal interviews of established vocologists, vocal pedagogues, medical professionals, and scientists in the field.

### *The History of Vocology*

The history of vocology is usually tracked starting with Manuel Garcia II, who developed the first indirect laryngoscope (Garcia 1841, 1847) in order to better understand his own singing voice. From what started as an interdisciplinary study in voice pedagogy and laryngology, the field has depended upon interdisciplinary aspects to grow and thrive. From Garcia’s time, developments in vocal pedagogy, laryngology (laryngeal imaging, pharmacology and surgery), voice science, speech pathology, and interdisciplinary voice care have converged to bring us to the interdisciplinary treatment of the voice.

*Vocal pedagogy.* As technological and scientific advances progressed from the time of Garcia, more voice scientists and singing pedagogues became interested in the science of the singing voice and music. One of the major figures in this pursuit was Hermann Helmholtz (1821-1894), a professor of physiology who developed an understanding of the fundamental frequency and overtones of pitches that provided the foundation for formant theory. His work with cadavers led to an understanding that the fundamental frequency was produced at the larynx and the overtones were altered by interaction with the vocal tract. He put forth this information and its application to the human voice in his work, *On the Sensations of Tone* (1862). Helmholtz's ideas were utilized by major pedagogues such as Delle Sedie (1822-1907), Emma Seiler (1821-82), and other scientific-minded pedagogues throughout the next century. In 1945, British pedagogue Douglas Stanley (1890-1958) published *Your Voice: Applied Science of Vocal Art*, which presented a scientific inquiry into vocal production.

Voice science continued its entry into mainstream vocal pedagogy with William Vennard (1909-71), who published *Singing, the Mechanism and the Technique* (1967). In the forward to his book, he boldly supported the use of science in pedagogy stating: "There are those teachers who feel that applying science to an art is quackery, but I believe that our only safeguard against the charlatan is general knowledge of the most accurate information available" (Vennard, 1967, p. iii). Ralph Appelman (1908-1993), in *The Science of Vocal Pedagogy* (1967), made an attempt to explain the scientific principles of voice production, but his work was a bit too technical to be understood by most singers at the time and not technical enough for the scientific community. Berton

Coffin (1910-87) wrote a practical guide for singers on the modification of vowels based on acoustic theory in his book, *The Overtones of Bel Canto* (1989). Richard Miller (1926-2009) applied many scientific principles in his many vocal pedagogy books, including the standard pedagogy text, *The Structure of Singing* (1986). Now, with textbooks like Scott McCoy's *Your Voice: An Inside View* (2004), vocal pedagogy is commonly taught within the context of voice science and vocal health. McCoy's interactive CD-ROM companion to his text makes access to video and audio examples of acoustic and aerodynamic principles, vocal pathology, and other information clear and comprehensive. For an in-depth look at the history of classical vocal pedagogy from a general, as opposed to scientific, perspective, see Stark (2003).

*Laryngology.* Woodson (2006) credits the following developments as those most important in advancing knowledge in laryngology: the ability to examine the larynx, surgical technology, advances in knowledge of structure and function of the vocal tract, pharmacology, voice therapy, and objective voice assessment. He states: "Advances in voice care have been sparked by breakthroughs in optical technology, fueled by curiosity of the vocal system...The greatest understanding of the voice and vocal disorders will result from continued interdisciplinary collaboration among all those who care for those who treasure their voices (Woodson, 2006, p. 13).

A brief history of laryngoscopy can be found in Zeitels, S.M. & de Alarcon (2010). Seminal advancements in laryngology were the use of laryngeal rigid telescopic imaging, which was introduced in the late 1960s by Harold Hopkins, and flexible fiberoptic laryngoscopy, which was first reported in 1968 by Sawashima and Hirose. The

two were used clinically in 1974 and 1979, respectively. Video laryngoscopy and stroboscopy were introduced clinically in the 1980s. Also, the routine use of color motion pictures in laryngoscopy was introduced in the 1980s and 1990s. In the 2000s, the distal chip camera was introduced, allowing for larger and clearer laryngeal images. It makes sense, then, that voice care would begin to grow at around the same time as the major developments in laryngeal imaging.

*Voice science.* As technology advanced, scientists were able to determine more information regarding the function and anatomy of the voice. Two physicists with specific interests in the singing voice, Ingo Titze, PhD and Johan Sundberg, PhD, contributed greatly to the scientific understanding of the voice with their groundbreaking works, *Principles of Voice Production* (2000) and *The Science of the Singing Voice* (1987) respectively. These books explain the basic principles of the anatomy and physiology of the vocal tract and promote theories regarding resonance and vocal fold vibration. Science and technology influenced each other, leading to instrumentation advancements in acoustic and aerodynamic measurement (Baken & Orlikoff, 2000). Titze formed the National Center for Voice and Speech in 1990 as a center without walls with the mission of conducting research, educating vocologists, disseminating information about voice and speech, and providing referral services in order to help people around the world enjoy healthy and effective vocal communications ([www.ncvs.org/about\\_mission.html](http://www.ncvs.org/about_mission.html), accessed January 5, 2012).

*Speech language pathology.* Although singing voice is not typically addressed in the education of a speech-language pathologist, there are an increasing number of speech-language pathologists who are trained to work within a singing voice team or to work independently as a dual-trained voice pedagogue/speech-language pathologist. This trend toward dual-trained professionals began within the last 20 years, approximately. In the 2000s, a singing voice specialist was typically defined as a voice teacher with special training (and not a speech-language pathologist with training in voice). In 2002, Heman-Ackah et al. defined the singing voice specialist as “a singing teacher with special training equipping him or her to practice in a medical environment with patients who have sustained vocal injury” (Heman-Ackah et al., 2002, p. 142). Sataloff et al. also described a singing voice specialist as a voice teacher in 2006, but they expanded the expected skills of this specially trained voice teacher to be:

...an experienced and specially trained voice teacher, usually with a degree in voice performance or pedagogy, who has professional voice performance experience, training in anatomy and physiology, training in the rehabilitation of injured voice users, and other special education. In addition to these basics, the singing voice specialist must acquire familiarity with objective voice measurement equipment and assessment; gain a basic understanding of the principles of laryngology and medications used commonly in this patient population and their potential effects, if any, on the voice; and have a fundamental knowledge of the principles and practices of speech-language pathologists. Being able to relate to performance demands based on personal experience is most helpful. It is critical that a singing voice specialist has an exceptional ability to hear minute changes in vocal quality and be an astutely demanding perfectionist. It is also desirable (but not essential) for the singing voice specialist to have reasonably good keyboard skills...The singing voice specialist must first be an excellent singing teacher, should have extensive training in the singing voice, and, ideally, have personal experience as a professional singer. (Sataloff et al, 2006, pp. 272-273).

Just as career voice teachers gain additional training in medical voice rehabilitation and voice science to become singing voice specialists, some speech-

language pathologists seek additional training in vocal pedagogy and voice science.

While many of these professionals still call themselves singing voice specialists, Linda Carroll, PhD, CCC-SLP suggests that these professionals should be called “vocologists”:

During the past 15 years, a new “crop” of multidisciplinary speech-language pathologists has emerged: the vocologists. Vocologists are speech-language pathologists (individuals with a Master’s or Doctorate in speech-language pathology) with prior experience in the performing arts (singing or theater), and additional training in voice research and interdisciplinary clinical management. Vocologists are trained to pay attention to the fine details of professional voice use while establishing an overview of perspective on the best management of voice disorders. Because vocologists are few in number, many laryngologists have expanded their voice team to include a voice specialist (specialized voice teacher or specialized acting trainer) (Carroll, 2006, pp. 585-586).

The term “vocologist” does not currently indicate that someone is a speech-language pathologist with special training in the singing voice, as Carroll proposes. But, Carroll’s explanation of the multidisciplinary speech-language pathologist indicates a shift that occurred in the first decade of the 21<sup>st</sup> century toward speech-language pathologists taking a greater role in singing voice rehabilitation. In fact, she implies that if multidisciplinary speech-language pathologists were more plentiful, laryngologists would hire them instead of “voice specialist” singing voice teachers.

Sataloff et al. bring to light a caveat regarding legal complications surrounding licensure requirements for the provision of therapeutic services in a medical setting:

It is illegal in most states for a singing teacher to provide therapy for an injured or pathological voice unless he or she meets licensure requirements, most of which are equivalent to certification by the American Speech-Language Hearing Association. As stated earlier, however, speech-language pathologists generally do not receive training in the care of the professional voice. Very few speech-pathology training programs provide instruction on care of the professional speaker, and most have no training in the singing voice at all...At present, if an independent voice teacher accepts a student for “voice rehabilitation” without having the student work concurrently with a licensed speech-language pathologist, that teacher may be subject to litigation, even if the student is referred by a laryngologist. A good interdisciplinary team working under one roof not only

provides optimal patient care, but also obviates potential legal problems of this sort. (Sataloff et al., 2006, p. 273).

The legal barriers to voice teachers providing rehabilitative services to singers described by Sataloff et al. can be (and are often) eliminated by having a dual-career voice pedagogue/speech-language pathologist as part of the voice team (i.e. MM or DMA in vocal pedagogy and MA or MS in speech-language pathology or the equivalent). In this situation, the injured singer receives the expertise of a highly trained singing teacher and a specialized speech pathologist at the same time.

While this concept has not yet appeared in the literature, it is apparent in current trends. For example, many high-level voice centers employ dual-career speech-language pathologists/vocal pedagogues to work with singers, including: Rosemary Ostrowski, MM, MS, CCC-SLP (Jefferson University), Leda Scearce, MM, MA, CCC-SLP (Duke University), Marina Gilman, MM, MS, CCC-SLP (Emory), and Ellen Markus, MA, CCC-SLP, DMA (University of North Carolina). Furthermore, a recent job posting for the Voice and Speech Department at the Massachusetts Eye and Ear Infirmary stated, “We are seeking a full-time clinically certified speech pathologist/professional voice specialist with a minimum of 3 years clinical experience and a degree in Voice Performance or Vocal Pedagogy to treat our professional voice patients. Equivalent depth of knowledge or experience with the singing voice will be considered” (Bunting, 2012). Clearly, leaders in the field are looking for dual-career clinicians to treat injured singers at the highest standard of care levels.

*Interdisciplinary voice care.* The Voice Foundation was founded in 1969 by voice specialist Wilbur James Gould, M.D. At that time, interdisciplinary care for the

singing voice was nonexistent. Dr. Gould called for the interdisciplinary cooperation of physicians, scientists, speech-language pathologists, performers and teachers to care for the professional voice user. In 1971, the first Voice Foundation annual symposium was held at The Juilliard School in New York City. The purpose of the foundation was to foster voice medicine, science and education (see Chapter Four for further information). Robert Thayer Sataloff, MD, DMA, FACS, a world-renowned otolaryngologist and a professional singer and conductor, became the chairman of the Voice Foundation in 1989.

Now, as ideas continue to be exchanged and technology continues to advance, the level of understanding of voice care has given way to an interdisciplinary model for habilitation and rehabilitation of the singing voice. Currently, several areas of the field benefit from these practices: medical voice centers are now focusing on the care of the singing voice; universities are developing interdisciplinary programs for specialization in vocology/singing health; voice pedagogues and scientists have a better understanding and acceptance of the healthy production of a range of singing styles; music schools offer more scientifically-based voice pedagogy programs; and there is an increase in the practical application of affordable and effective instrumentation in both therapeutic and pedagogical settings. Conferences and professional organizations continue to bring people together and advance education regarding voice health and science.

## CHAPTER 2: TECHNOLOGY AND INSTRUMENTATION

Technology for the habilitation of the singing voice is plentiful, and it is becoming increasingly accessible with developments in voice and technology. Instrumentation can be very helpful in the assessment of voice, the treatment of voice disorders, and in the voice-teaching studio. Instrumentation ranges greatly in price, level of technology (high- to low-tech), training requirements, and function. For the purposes of this study, technological devices will be discussed in the following categories: visual imaging, acoustic measures, electroglottography, aerodynamic measures, and electromyography.

This chapter will present a general overview of available instrumentation and a review of how instrumentation is currently being used in medical settings and in the voice studio. For a detailed review of instrumentation, see: Baken & Orlikoff (2000); Stemple et al. (2010, pp. 39-191); Benninger et al. (1993); Benninger & Murry (2006); Sataloff (2005); DeJonckere (2006). Stemple et al. (2010) provide an especially helpful resource for the creation of this instrumentation guide. Table 1 (based upon Stemple et al., 2010, p. 141) illustrates a summary of instrumental measures of the voice.

*Visual imaging.* Visual imaging can be further divided into internal (laryngoscopy) and external (standard video recording) imaging. Internal imaging is most commonly performed in a medical setting by a trained medical professional, whereas external video imaging may be used across settings as a valuable tool for habilitation. The best resources for learning more about laryngoscopy include:

Table 1. Instrumental Measures for the Voice Studio and Voice Laboratory

Technique	Information	Typical Place of Use
Laryngeal imaging (internal)	Gross structure and movements Vibratory characteristics Vibratory onset and offset (real time imaging only)	Medical voice center (performed by physician or speech-language pathologist – varies by state)
Video imaging (external)	Physical movements	Voice studio
Acoustic recording and analysis	Fundamental frequency Intensity Signal/harmonics-to-noise ratio Perturbation measures Spectral features	Medical voice center and voice studio
Aerodynamic measurement	Airflow rate and volume Subglottal (intraoral) pressure Phonation threshold pressure Laryngeal resistance	Medical voice center and voice studio
Inverse filter	Glottal waveforms of acoustics or airflow	Medical voice center (research)
Electroglottography (EGG)	Measure of vocal fold contact area	Medical voice center and voice studio
Electromyography (LEMG)	Direct measures of muscle activity	Voice center (performed by physician only)

Sataloff et al. (2006), Woo (2010), and Kendall & Leonard, (2010). In his *Atlas of Laryngoscopy* (2007), Sataloff describes the normal vocal folds and techniques for obtaining a good laryngoscopic view. The bulk of the text contains images and cases of mucosal abnormalities, vascular abnormalities and related conditions, benign lesions, and other forms of vocal fold disorders. Due to the high-resolution images and explanations, it is an excellent resource for anyone who is interested in honing his or her laryngoscopic skills. There are many contributing authors (practicing otolaryngologists) who have come together to make this resource available to the public. Many of the cases described involve professional voice users.

Laryngoscopy is an examination of the larynx, which can be done indirectly with a hand mirror or directly with a laryngoscope. Indirect laryngoscopy is done by shining a light into a person's mouth and using a hand mirror to reflect the image of the larynx. The obvious limitations of indirect laryngoscopy are the distance of the mirror from the vocal folds and discomfort for the patient.

Direct laryngoscopy can be done with a fiber-optic flexible or rigid laryngoscope. A flexible endoscope with a fiberoptic cable is inserted through the nose and passed through the velopharyngeal port to access images of the larynx from a close distance and without inhibiting the articulators. Therefore, this provides a view of the larynx while the patient is awake and alert and able to phonate at a normal or close to normal state. This is an excellent mode for examining the larynx during singing and speaking.

The rigid laryngoscope is inserted through the patient's mouth and is able to provide a view of the larynx via the angled lens at the end of the scope. This type of laryngoscope provides a very high quality image for of the larynx. It does not capture normal vocal fold motion, however, since the patient is not able to talk normally (the tongue is held by the examiner, thus limiting all of the articulators). It is also difficult for some patients to withstand the rigid scope due to an overactive gag reflex and/or vomiting. But, it is the best method to identify abnormalities of the vocal folds because of its clear image quality and magnification capabilities.

During both flexible and rigid laryngoscopy, it is possible to examine the patterns of movement in the vocal folds by using stroboscopy in coordination with the exam. Since the rate of normal vocal fold movement is too fast to be perceived by the human eye (over 80 cycles per second at the low end), the strobe light (set at a frequency that

approximates but is not exactly that of the vibration of the vocal folds) produces a string of images that imitates the real cycle of the vocal fold vibrations. Information regarding stiffness, tone and motion of the vocal folds is obtained through this type of examination. Currently, the standard and most common stroboscopic system is KayPENTAX (Lincoln Park, NJ) Rhino-Laryngeal Stroboscope (Kendall, 2010). This system captures a somewhat under-sampled and averaged estimate of the vocal fold vibratory cycle, about 60 fields per second. It is now possible to capture up to 10,000 frames per second (true intercycle vocal fold motion) during high-speed video endoscopy. High-speed imaging allows for the viewing of vocal onset and offset, an especially important part of phonation for singers. Kymography, a new real-time imaging technique in which a camera is used to scan a single horizontal line of vocal fold vibration, also produces a high sampling rate (8,000 lines per second). For a detailed description of laryngeal evaluation, see Kendall & Leonard (2010).

Video recording has much value in the medical and voice teaching settings. Standard video recording can be used to set a baseline, document progress, and provide unbiased biofeedback to the singer. A separate computer drive is suggested for storing video. Also, with the many possibilities available through the internet, it is recommended that an H3 recorder (Sony) or another such device is used to capture video and upload to sites like YouTube in seconds (Olson, Interview, Feb. 4, 2012). Videos can be uploaded to the computer and sent out to individual students or clients from video recorders via email or DVDs for students to use at home.

Slow-motion video provides especially valuable information for singers. Video Analysis Software now allows for video replay at different speeds, image-by-image, fast

forward/backward, zoom, magnification, mirror video horizontal and vertical, picture-in-picture, and measurements with data tables. Slow-motion video recording is used in the field of vocal pedagogy by William Stone, DMA. It makes sense to use slow-motion video recording with singers, since this type of biofeedback is common in sports training and therapy. Many athletic disciplines use this type of software to help athletes see the physical subtleties that affect their performance. For example, a pitcher may use a slow-motion video system to record himself throwing a pitch. The pitch can then be reviewed in regular or slow motion to determine motions that may be effective or ineffective. Likewise, in singing, slight muscle tension, changes in posture, movements of the jaw or neck, and changes in lip and tongue position can be observed in both standard and slow-motion video. The room can be arranged so that there is a three-panel mirror placed behind the singer, so as to capture all sides of the singer. When reviewing slow motion video, a movement that is almost invisible to the naked eye can become quite obvious. The possibilities are impressive if the software is used creatively; videos can be reviewed, stored, and compared to other films in multiple screen views. This concept could benefit from further exploration via research, as there are currently no studies regarding the use of slow-motion video in the teaching studio. Dartfish video software is ideal for use in the voice studio. See [www.dartfish.com](http://www.dartfish.com) for more information.

*Acoustic measures.* Acoustic instrumentation can be used to obtain the following information: audio recordings, vocal intensity measures, a voice range profile, and spectral analysis. One first must consider the microphones and recording environments being used when making acoustic measurements and recordings. Microphones should

“conform to recommended technical standards, including a professional grade, condenser-type microphone with unidirectional or cardioid filtering characteristics” (Stemple et al., 2010, p. 143). The microphone should be placed slightly to the side of the mouth to avoid aspiration noise and at a distance that is consistent for each patient. Voice students should wear a headset microphone (one designed for speech recognition) so that the distance from a student’s mouth to the microphone can be kept stable during recording. The clinician or voice teacher should be aware of ambient noise, which can degrade the quality of the recording. The minimum signal-to-noise ratio in the environment should be 42 decibels (Stemple et al., 2010, p. 143).

Standard audio recordings, like video recordings, can be saved as baseline information, to document progress, and as unbiased biofeedback. This can be arranged in delayed feedback (standard). Closed-loop real-time playback is used to help students receive biofeedback during singing. This allows for singers to hear themselves from an outside source (through their ears) as opposed to the standard hearing through the ears as well as bone/body conduction of the sound. Systems such as Superscope Digital Recording Systems allow for recording directly to a CD and dual CD use (for playing backup accompaniment tracks while recording a session, for example) (Leda Scearce, personal communication, February 17, 2012). See <http://www.superscopetechnologies.com/c-3-digital-recording-systems.aspx> (accessed February 17, 2012) for more information.

The teacher can also utilize an external computer drive dedicated to saving the video and audio recordings of his or her students. With an external drive system, files may be stored for data of baseline abilities and progress and may be referred to whenever

necessary. Furthermore, files can be emailed to the student directly from the external drive database.

Acoustic analysis is the measurement of the sound signal produced by the vocal folds. It can measure intangible components of the voice, like frequency (an acoustic measurement of the perceptual judgment of pitch), amplitude (loudness), perturbation measures (assessment of cycle-to-cycle variation in the acoustic waveform for frequency or intensity), ratio of signal energy-to-noise (which tells the relative amount of periodic and aperiodic [noisy] components of the acoustic signal) and spectral features (which represent vocal tract harmonic energy, the perceptual judgment of quality). It is useful most importantly for its provision of objective data relative to a set of normal values (Benninger et al., 1993). It is also possible to take baseline information and compare progressive recordings to document progress.

A person's vocal intensity is measured in sound pressure level (SPL) and corresponds with perceived loudness. A simple sound envelope can be used to determine intensity. Sound level meters are inexpensive and can be used to measure intensity more accurately. Many smart phones now have sound level meters as apps. Otherwise, the device may be purchased on its own (see Table 2).

The signal-to-noise ratio determines the ratio of harmonic (periodic) to noisy (aperiodic) energy in the voice signal. A high signal-to-noise ratio is indicative of a voice with a high harmonic component, which is normally considered healthy in singing and speaking. Signal-to-noise ratio can be computed via the perturbation measures on the Computerized Speech Laboratory system.

A spectral analysis provides information regarding fundamental frequency and formants. The power spectrum is a graph of the frequency (horizontal axis) and intensity (vertical axis) of an acoustic signal at one point in time. Fast Fourier Transformation (FFT) and Linear Predictive Coding (LPC) are both used to compare many spectra and observe the changes throughout a voice sample. While a spectrum shows the voice signal at one moment in time, the spectrogram is a visual display (graph) of the voice signal over time. The output places time (horizontal axis), frequency (vertical axis) and intensity (color scale) in a three-dimensional graph. The lowest energy band represents the fundamental frequency. The harmonics (integer multiples of the fundamental frequency) form bands above the fundamental frequency at equal intervals, and the intensity of energy at each harmonic is shown by the color grade of the band, representing intensity. Spectrograms can be displayed in wide or narrow bands. For singers, it is desirable to use narrowband spectrogram displays with a frequency range of about 5,000 Hz to visualize the output of most human sound (Miller, 2008). However, some clinicians and singing teachers may be interested in high-frequency energy, about which more scientific studies are revealing new information (Monson, 2011). From spectral analysis in general, it is possible to see information about formants (resonances of the vocal tracts /vowels), noise (aperiodic and transient noise), and vibrato. For singers, this is very important. While there is no “perfect standard” for singers, a skilled practitioner can use a spectral analysis to guide a singer toward the type of production that he or she would like to see.

A Voice Range Profile (also known as a phonetogram, and the physiologic frequency range of phonation) gives information regarding the range of intensity and

frequency produced by a person. The output is a graph with frequency on the horizontal axis and intensity on the vertical axis. In addition to this objective data, subjective observations regarding quality of voice should also be notated by the clinician. For example, an examiner would note whether a person has a lot of muscle tension when producing high frequency tones. This information will only be available from observation during the voice range profile by the clinician or voice teacher.

*Electroglottography.* Glottal Measurements may be taken through electroglottography (EGG), a noninvasive tool that measures vocal fold contact through the use of electrical current. The subject must wear a collar with two electrodes on either side of the thyroid cartilage. Through this instrumentation, it is possible to obtain information regarding when the vocal folds are in contact (adducted) or apart (abducted). The resulting electroglottograph shows a real-time display of the open and closed pattern of the vocal folds. This is often used in combination with stroboscopy to determine the fundamental frequency and ensure that it is not interfering with the stroboscopic flash rate. It is also used in combination with other acoustic and aerodynamic measures.

Some examples of software/hardware that may be used to obtain acoustic and EGG measures are listed below in Table 2 (compiled with assistance from Monson & Story, 2010). Pricing for the programs ranges from free to very expensive. Table 2 may be complemented by the website <http://www.speechandhearing.net/laboratory/tools.php> (accessed February 17, 2012), which provides further information regarding freely downloadable acoustic analysis software.

Table 2. Instrumentation for Acoustic Measurements

Program	Mac/PC	Function and comments	Website	Cost
<b>Mini Digital Sound Level Meter;</b> CEM (Parts Express)	NA	Measures noise and sound in the environment.	<a href="http://www.amazon.com/Mini-Digital-Sound-Level-Meter/dp/B001THX3M0/ref=sr_1_fkmr0_1?ie=UTF8&amp;qid=1329246298&amp;sr=8-1-fkmr0">http://www.amazon.com/Mini-Digital-Sound-Level-Meter/dp/B001THX3M0/ref=sr_1_fkmr0_1?ie=UTF8&amp;qid=1329246298&amp;sr=8-1-fkmr0</a>	\$27
<b>iPad, iPhone, iPod and iBook apps</b>	Mac (iProducts)	There are several apps to measure pitch, sound level and other aspects of voice. Clinicians are cautioned when using these because the iPhone and iPad come with low-level audio hardware, which makes it difficult to assure reliable results. These devices are not calibrated and have a limited SPL area (Ingolf Franke, SID3 posting, 2012).		Free or low-cost
<b>VRRP!!</b> (Christian Herbst, PhD student in biophysics at the Palacký University of Olomouc, Czech Republic)	Mac or PC	Includes voice range profile only. It is possible to save screenshots, but not files, of the voice range profiles.	<a href="http://homepage.univie.ac.at/christian.herbst/vrrrp/index.php">http://homepage.univie.ac.at/christian.herbst/vrrrp/index.php</a>	Free
<b>Raven Lite</b> (Cornell Lab of Ornithology)	Mac or PC	A software program that lets users record, save, and visualize sounds as spectrograms and waveforms.	<a href="http://www.birds.cornell.edu/brp/raven/RavenOverview.html">http://www.birds.cornell.edu/brp/raven/RavenOverview.html</a>	Free (more advanced versions are available for a fee)

Table 2. (continued)

Program	Mac/PC	Function and comments	Website	Cost
<b>Audacity</b> (Developed by a group of volunteers and distributed under the GNU General Public License)	Mac or PC	Audacity is a free, easy-to-use and multilingual audio editor and recorder. It can measure sound level, provide spectrograms and plot spectrums in real time. You can use Audacity to: record live audio; convert tapes and records into digital recordings or CDs; edit Ogg Vorbis, MP3, WAV or AIFF sound files; cut, copy, splice or mix sounds together; change the speed or pitch of a recording.	<a href="http://audacity.sourceforge.net/">http://audacity.sourceforge.net/</a>	Free
<b>Wavesurfer</b> (Sourceforge and KTH, Department of Speech, Music and Hearing, Stockholm, Sweden)	Mac or PC	“WaveSurfer is an open source tool for sound visualization and manipulation. Typical applications are speech/sound analysis and sound annotation/transcription. WaveSurfer may be extended by plug-ins as well as embedded in other applications.”	<a href="http://sourceforge.net/projects/wavesurfer/">http://sourceforge.net/projects/wavesurfer/</a>	Free
<b>Praat</b> (Paul Boersma and David Weenink, Phonetic Sciences, University of Amsterdam)	Mac or PC	Includes: Spectrogram analysis, pitch analysis, formant analysis, intensity analysis, jitter, shimmer, voice breaks, cochleagrams and excitation patterns	<a href="http://www.fon.hum.uva.nl/praat/">http://www.fon.hum.uva.nl/praat/</a>	Free

Table 2. (continued)

Program	Mac/PC	Function and comments	Website	Cost
<b>GoldWave</b> (Developed by GoldWave Inc.)	PC	GoldWave is a highly rated, professional digital audio editor. It is fully loaded to do everything from the simplest recording and editing to the most sophisticated audio processing, restoration, enhancements, and conversions. It is possible to view spectrograms, level meters, waveforms, and record.	<a href="http://www.goldwave.com/gwbuy.php">http://www.goldwave.com/gwbuy.php</a>	1 year \$19 Lifetime \$49
<b>VoceVista</b> (Donald Miller, PhD, Amsterdam, The Netherlands)	PC	Includes hardware/software for real-time spectrum analysis and electroglottography. VoceVista displays the signals in combinations of three basic formats: spectrogram, power spectrum, and high time-resolution waveforms.	<a href="http://www.vocevista.com">www.vocevista.com</a>	\$70, includes <i>Resonance in Singing</i> textbook by Donald Miller To order: <a href="http://www.voiceinsideview.com/order.htm">http://www.voiceinsideview.com/order.htm</a>
<b>Sing &amp; See</b> (Dr. William Thorpe, Dr. Jean Callaghan et al., University of Sydney, Australia)	Mac or PC	Includes pitch trace (with piano keyboard highlighting or stave view), spectrogram display, real time spectrum, and level meter. Dual screen display and recording capabilities are included in the professional version.	<a href="http://www.singandsee.com">www.singandsee.com</a>	Student \$49 Pro \$99 Teacher Pack with manual \$169

Table 2. (continued)

Program	Mac/PC	Function and comments	Website	Cost
<b>SignalScope 2</b> (Faber Acoustical, LLC)	Mac	Includes FFT analyzer, oscilloscope, spectrogram, and x/y plotter. All analysis tools within SignalScope offer more advanced measurement configurations, which can all be saved in project files, along with the measurement data itself. Significant new features in SignalScope include comprehensive AppleScript support, direct comparison of captured and live signals, and multi-channel analysis.	<a href="http://www.faberacoustical.com/products/signalscope/">http://www.faberacoustical.com/products/signalscope/</a>	\$99
<b>Voice Clinic Suite</b> (lingWAVES)	PC or Mac with Boot Camp and installed Windows	Includes sound level meter, voice recording, comparison of recordings, editing, patient manager, print out function, screen shot function, client and database backup, voice disorder index, spectrogram, vospector voice quality measurement, visual feedback (theravox, real-time pitch and spectrogram), standard singing voice range profile, EGG.	<a href="http://www.lingwaves.com">www.lingwaves.com</a>	High-cost; Contact lingWAVES sales for pricing.
<b>Computerized Speech Lab (CSL)</b> (KayPENTAX)	PC	Fully integrated hardware and software. Software options include multi-dimensional voice program (perturbation measures), voice range profile, real-time and therapy applications (pitch, spectrogram, EGG, auditory feedback, voice games), and a disordered voice database.	<a href="http://www.kaymetrics.com/index.php?option=com_product&amp;Itemid=3&amp;controller=product&amp;task=learn_more&amp;cid[]=11">http://www.kaymetrics.com/index.php?option=com_product&amp;Itemid=3&amp;controller=product&amp;task=learn_more&amp;cid[]=11</a>	High-cost; Contact KayPentax sales for pricing.

*Aerodynamic measures.* Aerodynamic measures for subglottic pressure and transglottic flow need to be taken indirectly, since it is nearly impossible to get a direct measure at the glottis. These derived measures can be used in various ratios to gain information about glottal power, laryngeal resistance, and vocal efficiency. The most common aerodynamic measurement worldwide is maximum phonation time in seconds (DeJonckere, 2006, p. 21). It requires only a stopwatch, and it gives the longest expiratory voicing for a person based upon three trials averaged together. Vital capacity, measured using a handheld spirometer, is the “volume change at the mouth between the position of full inspiration and complete expiration” (DeJonckere, 2006, p. 92). More hi-tech aerodynamic equipment needs to be calibrated regularly to ensure accurate measurements.

The most common airflow measurement device is the pneumotachograph, which is basically a metal tube with a mesh screen or series of small tubes that provides resistance. It estimates the flow rate by measuring the pressure before the point of resistance and after the point of resistance, calculating flow and dividing it by time (flow divided by time equals the flow rate). An airflow mask must be coupled to the tube, and the mask must be airtight to avoid leaks. The Rothenberg mask was developed especially for this purpose. In a Rothenberg mask, mesh screen vents create the resistance needed to measure pressure. The pressure inside the mask is taken as the first pressure measurement. The pressure outside of the mask (atmospheric pressure) is used as the second, post-resistance measurement. Average flow is calculated by the patient holding the mask in place and voicing a steady vowel at normal pitch for 5 to 10 seconds. Hyperfunctional voice or glottal fry will produce low airflow rates. Breathly voices with

glottal incompetence will produce high airflow rates. Airflow volume is a measure of the amount of flow during a given speech task. To obtain this measurement, a person holds the mask in place, inhales deeply and exhales on a comfortable vowel sound for as long as possible. This measures a person's breath supply for speaking or singing tasks.

Subglottal pressure is the force below the adducted (closed) vocal folds. Eventually the subglottal pressure overcomes the resistance of the vocal folds, and the vocal folds are set into vibration. While the pressure is one variable, vocal fold tissue and laryngeal muscular function contribute to how much subglottal pressure is needed to set the vocal folds into vibration. Though direct measurement involves insertion of a needle into the trachea, an estimate can be achieved by measuring intraoral pressure during the production of /p/ (an oral plosive in which the vocal folds are open and the pressure in the oral cavity is equal to that which would be available at the vocal folds). A person will say /pi/ repeatedly into a small tube connected to a pressure transducer. This is not ideal for singers, as subglottal pressure cannot be obtained in a more realistic sustained singing situation. Therefore, Dr. Titze is developing a dual-cannula oral manometer, which is a straw method requiring low-tech, inexpensive equipment. The concept is to maintain a semi-occlusion without shuttering (/pi pi pi pi pi pi pi/), but instead have a sustained vowel sound. The two cannulas include one for pressure measurement and one for release of airflow from the mouth that allows for the constant phonation. This system, when completed, would be excellent for singers, because singers may take measurements while phonating.

Phonation Threshold Pressure can be thought of as the amount of effort needed to start voicing. This minimal driving pressure required to set the vocal folds into

oscillation is estimated using intraoral pressure during repeated syllable /pi/ at the minimal loudness possible. Healthy vocal folds usually require a lower phonation threshold pressure to be set into oscillation. When voices fatigue, they often have a higher phonation threshold pressure, probably because of vocal fold edema. Titze & Hunter are developing the oral pressure range profile, which will be obtained with a dual-catheter manometer (pressure gauge). The participant will perform pitch glides (1-2 octaves) to obtain phonation threshold pressure and maximum effort phonation pressure. If the study is successful, this method would pose an alternative to the voice range profile.

Laryngeal resistance combines the measures of pressure and flow into in a ratio. In general, it is an estimation of the total resistance at the glottis and can give an idea of the function of the laryngeal valving mechanism (too tight, too loose, or normal).

Inverse filtering is a derived measure taken from acoustic or aerodynamic signals that gives an estimate of the glottal wave flow. The idea is to cancel out the effects of the resonance tract from the sound source and determine the wave at the glottal sound source. Examples of common instrumentation used to take aerodynamic measurements and feedback are listed in Table 3.

*Electromyography.* Laryngeal electromyography measures laryngeal muscle activity. It requires that needles be inserted into muscles and must be performed by a trained neurologist or otolaryngologist.

Table 3. Instrumentation for Aerodynamic Measurements

Product	Function	Website	Cost
<b>PG-20 Subglottal Pressure Extrapolation System</b> (Glottal Enterprises, Martin Rothenberg)	Estimates subglottal pressure with a real-time meter indication of the estimated pressure. There is a model PG-100 that measures high pressures up to 100 cm H <sub>2</sub> O that are typically found in singers.	<a href="http://www.glottal.com/">http://www.glottal.com/</a>	Low-cost
<b>Dual-Cannula Oral Manometer (Straw Method)</b> (Ingo Titze, National Center for Voice and Speech)	In progress. Infers phonation threshold pressure and subglottal pressure by maintaining a semi-occlusion without shuttering. An oral pressure range profile can be taken with a dual-catheter manometer (Titze & Hunter, 2012).	NA	Low-cost; not yet for sale
<b>Aeroview Phonatory Aerodynamic System</b> (Glottal Enterprises, Martin Rothenberg)	Measures average glottal flow resistance and conductance and calculates the average glottal flow and interpolated subglottal pressure. This is a software system that works with any Windows XP computer and requires no hardware installation. It can be easily moved between computers. Works in coordination with the appropriate Glottal Enterprises masks.	<a href="http://www.glottal.com/Products/aeroview.htm">http://www.glottal.com/Products/aeroview.htm</a>	High-cost; contact sales for pricing.
<b>Waveview System</b> (Glottal Enterprises, Martin Rothenberg)	Conducts inverse filtering during speech and singing. It also computes average airflow and sound pressure level. It can analyze mask or microphone signals. The program can work in coordination with a simultaneous EGG signal. It can be coordinated with VoceVista for singing voice analysis. It can be purchased as a complete turnkey system or as a software to use with already purchased hardware.	<a href="http://www.glottal.com/Products/aeroview.htm">http://www.glottal.com/Products/aeroview.htm</a>	High-cost; contact sales for pricing.
<b>Phonatory Aerodynamic System (PAS) (KayPENTAX)</b>	Calculates average phonatory flow rate, sound pressure level, fundamental frequency, vital capacity, glottal resistance, subglottal pressure (derived), and efficiency measures. The full turnkey system includes software and hardware (face mask, pneumotach, pressure transducer, tubing, and microphone).	<a href="http://www.kaypentax.com/index.php?option=com_product&amp;Itemid=3&amp;controller=product&amp;task=learn_more&amp;cid[]=75">http://www.kaypentax.com/index.php?option=com_product&amp;Itemid=3&amp;controller=product&amp;task=learn_more&amp;cid[]=75</a>	High-cost; contact sales for pricing.

*Current practice for instrumentation in medical settings.* To determine the current state of technology use in medical settings related to the injured singing voice, informal interviews of clinicians at several voice centers specializing in treating singers were conducted. See Table 9 (Appendix B, p. 112) for survey topics. Clinicians from both large university centers and smaller private practices were included in the survey: six clinicians at university voice centers and five clinicians in private practices. The results of the survey showed that instrumentation is used mainly in the assessment, as opposed to the treatment, of patients. Most clinics are using KayPENTAX instruments, including the endoscopic and stroboscopic equipment, the Computerized Speech Laboratory (CSL), and the Phonatory Aerodynamic System (PAS).

All clinicians responded that endoscopy is used during the evaluation of patients and at follow-up visits with the physician. The most common type of endoscopy for singers is flexible endoscopy, preferably with an HD endoscope but often with a distal chip. Stroboscopy is almost always used during the endoscopic exam. The voice center at the University of Wisconsin Madison takes high-speed images of all voice patients, as well. All university voice center clinicians reported taking acoustic measures using the KayPENTAX CSL system with very little variation in data collection protocols (i.e. habitual pitch, signal-to-noise ratio, pitch range, voice range profile, multi-dimensional voice profile). All university voice center clinicians also reported taking aerodynamic measures with the KayPENTAX PAS system. Flow and Pressure measures are recorded using similar techniques from center to center (i.e. shuttered /pa pa pa pa/ and maximum phonation on /a/). The majority of clinicians in private practice reported taking limited or no acoustic/aerodynamic measures for their clients. Some reported lack of time and

limited access to equipment (secondary to working in a small, yet busy private practice) as the reason for this limited data collection. Most clinicians reported that the acoustic and aerodynamic measures are most useful for documentation and insurance billing, but that it does not have much influence on the course of diagnosis or treatment. Only one clinician claimed that these acoustic and aerodynamic speech results are very important to her treatment planning for singing voice therapy.

Clinicians reported using very limited instrumentation in the course of singing voice therapy. Three clinicians, however, described using audio and video recording equipment successfully in the therapy room. Leda Scarce, MM, MS, CCC-SLP, director of the Performing Voice Programs at the Duke Voice Care Center, stated that she records every therapy session using a Superscope digital recording system. During the session, she often plays back portions of the recording to patients as auditory feedback. At the end of the session, she always gives the CD recording of the session to the patient in order for the patient to be able to practice and review (Leda Scarce, personal communication, February 17, 2012). Bryn Olson, MS, CCC-SLP, while a clinical fellow at Emory Voice Center, concentrated on the use of standard video recording in her treatment of patients with voice disorders. She posted general instructional videos on Youtube.com for her clients and created supplemental tailored videos for clients in the final minutes of their sessions. These tailored videos were structured like mini voice therapy sessions in which Ms. Olson would model tasks and the patient would attempt to perform the task after the model. Although there is no official study yet, Ms. Olson hopes to work more on this topic in the future, since it was very helpful to her patients based on subjective feedback (Bryn Olson, personal communication, January 28, 2012).

Overall, clinicians seemed receptive to the idea of using technology in the therapy room. It is clear from the results of this small informal survey that very few clinicians are using available technology in singing voice therapy sessions. What is unclear, however, is the reason why the technology is not being used. Is the technology ineffective in singing voice therapy or is it effective, but simply not a part of common current practice. According to Douglas Roth, a PhD candidate in communication sciences (voice) at the University of Pittsburgh, the principles of motor learning contraindicate the use of simultaneous biofeedback in voice therapy. While this has not been directly proven in studies related to singing voice or speaking voice therapy, translational research shows that research performed in related fields in which simultaneous biofeedback precluded motor learning can be successfully applied to the field of voice therapy (Douglas Roth, personal communication, February 22, 2012). That being said, clinicians (including Douglas Roth) admit that it is useful to have biofeedback available in the therapy room and that delayed biofeedback via acoustic analysis or audio/video recording can be especially helpful to select clients. An effective way to answer the question of the usefulness of instrumentation and technology in the therapy room is to create studies testing the efficacy of biofeedback/instrumentation in singing voice therapy sessions.

*Current practice for instrumentation in pedagogical settings.* Not many vocal pedagogues use instrumentation in the voice studio. Furthermore, very few vocal pedagogues receive training in instrumentation for the analysis of the voice (Sataloff, 2005; Nair 1999). The vocal pedagogy community in general, however, is very open to learning more about voice science and technology related to singing voice analysis. In

her recent study that will be published in the *Journal of Singing* this year, Rachel Ware, DMA surveyed 520 voice teachers, and 80% reacted positively to incorporating more voice science into their teaching studios (Rachel Ware, personal communication, February 2, 2012). This indicates a significant shift in attitude from even a decade ago, when many voice teachers resisted the use of science in voice teaching. Given the shift in attitude, perhaps a shift in practice will follow.

To that end, increasingly more voice pedagogy programs have coursework that includes the use of technology in the studio, like at Shenandoah Conservatory, Westminster College Choir and New York University (see Chapter Four for further information). Some pedagogues, like Ken Bozeman and Brian Gill strongly advocate the use of technology in the voice studio. Most voice teachers, however, do not. Once again, there is the question as to whether this is a result of the instrumentation not being helpful or the instrumentation not being part of common practice, available to teachers, or for other reasons. In his 1999 publication, *Voice Tradition and Technology: A State-of-the-Art Studio*, Nair presents a review of technology for the voice teaching studio. In this forward-thinking, but now outdated book, he summarizes the practicality dilemma of technology in the voice studio:

Many scientists don't know enough about the highly trained singing voice to offer suggestions on how to employ the results of their research to good effect in the voice studio. At the same time, voice professionals – sensing no immediate practical application of research results – do not see the need to spend time and effort learning enough to understand the available scientific knowledge. Until both sides work on the practicality issue, little mitigation of this communication problem will occur and little of the great body of scientific knowledge will find its way into the voice studio (Nair, 1999, p. 10).

Objectively speaking, instrumentation serves two main positive purposes in the voice studio, namely documentation (baseline and progress information) and unbiased

feedback. In his chapter, “Use of Instrumentation in the Singing Studio,” Sataloff explains how objective instrumentation can be of use to voice professionals, including voice teachers:

The health and safety of patients and students in general are better served by more objective methods of voice assessment. For voice teachers, dependence on the ear alone gives rise to special problems. For example, there is sometimes disagreement as to which vocal productions are good and which are bad; whether a voice is the same, better, or worse after a year or two of training; what exactly is meant by “good” or “bad;” and so on. Consequently, it would be valuable for a singing teacher or music department to be able to assess accurately the vocal performance and progress of each student through objective measures of voice function repeated over time. Such technology is no substitute for traditional, excellent voice training. Rather, it provides an extra set of tools for the voice teacher to help identify specific problem areas and assure steady progress. Physicians have been faced with the same needs in diagnosing voice abnormalities and assessing the results of treatment. Consequently, instrumentation has been developed for medical voice assessment, and much of this instrumentation has potential application in the studio (Sataloff, *Treatment of Voice Disorders*, 2005, p. 95).

The positive implications of using technology/instrumentation in the voice teaching studio are far-reaching. Students and teachers benefit from seeing the pairing of the vocal signal with a tangible display, which acts as an objective third party in the room. In some cases, this allows for accelerated learning for both teachers and students (Nair, 1999; Miller, 2000; Madden, 2011). Having an objective teaching tool could potentially save time for a student who is able to understand via the technology, make changes accordingly, and carry the skills over to singing without the software. It also presents an unbiased feedback about the pitch, quality, and intensity of the tone, so that the teacher cannot become accustomed to the student and, therefore, miss inaccuracies. Acoustic analysis tools can also be used as feedback for target practice during vocalises or to track pitch to make sure that a student understands when he or she is going flat. This type of instruction can facilitate self-directed learning ([www.singandsee.com/forteachers.php](http://www.singandsee.com/forteachers.php),

accessed February 17, 2012). This is a good way to observe noise in the tone, vibrato, resonance, formant-to-harmonic relationships (belt/twang vs. classical tone) and evenness of tone. The students and teachers will be able to track their progress during a lesson and across months and years.

Students in the upcoming generations are comfortable with instrumentation, for the large part, and are happy to use computers and technology as part of their lessons if they understand its purpose. Furthermore, technology can increase the ability of the voice teacher to communicate with other voice team professionals (and vice versa) by supporting a more technical/science-based vocabulary surrounding voice and providing objective data for discussing vocal parameters. Overall, instrumentation provides objectification of vocal production, teaching methods for the correction of vocal faults, and a standardized, more objective terminology for use in the voice studio (Nair, 1999, p. 20).

Negative aspects of using technology in the voice teaching studio include potential dependence on the technology and a significant burden on the teacher to understand and correctly use the instrumentation. Some students may become attached to biofeedback in order to reproduce a specific desired tone, thus limiting transfer of learned skills to an instrumentation-free environment. On the other hand, some teachers may fear that they could be replaced or feel that computers interfere with the search for art. To avoid these situations, the teacher must have a firm understanding of the technology before using it in the studio. She/he must also use it as effectively and efficiently as possible to supplement a core technical method, not as a replacement for that core method. Unfortunately, some teachers misunderstand and misuse instrumentation to the

disadvantage of the student. The equipment is best used like a mirror, as needed for biofeedback. Since voice scientists have provided functional, practical and affordable instrumentation, it seems most prudent to have it available for situations in which it can be of use to a student.

Instrumentation serves an important role in the education of singing voice teachers on the acoustic nature of the voice. Scott McCoy, DMA, professor of voice and pedagogy at Ohio State University, believes that technology is more useful in helping someone become a good teacher than in helping someone become a good singer (Scott McCoy, personal communication, January 30, 2012). Technology can work wonders in the right circumstances as a trigger to find something different, but he only uses it occasionally in the voice studio. Christian Herbst, voice pedagogue and voice scientist, agrees with McCoy. He believes that it is most important for the pedagogue to learn from the technology and to understand the voice so as to make changes quickly. In the voice studio, he uses acoustic analysis on rare occasions when a student is not able to perceive his or her vocal output accurately or effectively without it (Christian Herbst, personal communication, February 10, 2012). Kathryn Green, DMA, a professor at Shenandoah University, uses technology as biofeedback in the teaching studio as needed. She certainly does not use it for every student, but there are students for whom it is very helpful to have a visual representation of the sounds they are producing. She is glad to have the technology available for those students (Kathryn Green, personal communication, February 2, 2012). Nair describes the situation well, stating that “the teacher’s knowledge of the voice becomes more objective through the use of digital analysis. The teacher will build a mental database of technical solutions that correlate

with the evidence on the monitor...Not only will the student improve, but a better, more versatile teacher will result as well” (Nair, 1999, pp. 19-20).

*References for vocal pedagogues regarding instrumentation in the voice teaching studio.* Nair provides a reference source in his *Voice Tradition and Technology: A State of the Art Studio* (1999) for basic concepts and terminology of voice science, the basis of voice analysis technology, and applications for voice analysis technology in the voice studio. The idea of this book is excellent, but the book is out of date, as it was written in 1999 and does not include more recent technologies available to teachers. For example, Nair instructs teachers to use a tape recorder for audio recordings, but tape recorders are now completely obsolete. Furthermore, Nair does not address the technology used in medical voice analysis (e.g. endoscopy, aerodynamic measures).

Although the technology referred to in the book needs updating, Nair’s work remains the best source for technology in the voice studio to date. Voice teachers could benefit from a new edition of this book with updated computer recording and storage information and expanded types of instrumentation. While some instrumentation is prohibitively expensive or complicated, many programs are free or low-cost and fairly simple to use (see above). These systems could be useful to have within the voice studio.

Donald Miller equips voice teachers with a practical guide to the application of acoustic analysis equipment in the voice studio. *Resonance in Singing* (Miller, 2008), explains the use of acoustic analysis equipment in training voice students and offers practical applications, albeit for more advanced singing. Miller describes many uses of the software, including tracking vowel consistency and the effects of facial and muscular

movements on the formants. He also explains how EGG can be used to track laryngeal function and how spectral analysis can facilitate formant tuning.

## CHAPTER 3: MEDICAL APPLICATIONS

Professional voice users, specifically singers, require special considerations during the assessment and treatment of voice disorders. “The laryngologist must differentiate professional voice users from all of his other patients; voice is crucial to the professional’s career and in many instances the career is the driving force and top priority of the professional’s life” (Rubin et al., 2006, p. 638). In order to work with injured singers, vocologists must understand the medical applications associated with vocal rehabilitation: the voice care team, voice care centers, singing voice assessment and therapy, voice disorders, vocal health/hygiene, and complementary and alternative medications and techniques. This chapter provides a review of the medical applications of vocology.

*Voice care team.* The voice care team consists of many professionals from various disciplines working together to help a voice user. The laryngologist (physician), speech-language pathologist (sometimes referred to as a voice therapist on voice teams), the singing voice or singing health specialist, the voice teacher and the voice coach work together as the core of this interdisciplinary team (Sataloff et al., 2006; Stemple et al., 2010).

The laryngologist is a physician who specializes in the assessment and treatment (surgical and non-surgical) of the voice. To become a certified laryngologist, a physician must graduate from medical school, complete a medical residency program, and complete a fellowship in otorhinolaryngology (ear, nose and throat). After that, special training in laryngology must also be completed.

A speech-language pathologist assesses and treats a wide range of speech, language, swallowing, and cognition disorders. To become a certified speech-language pathologist, a person must graduate from an accredited master's program with an MS or MA in speech-language pathology and complete a supervised clinical fellowship (36 weeks). In a standard speech-language pathology program, only one course in speech science (undergraduate level) and one course in voice disorders are required. No singing voice knowledge is required in SLP training. Only some schools briefly address professional voice users as a population. Therefore, a speech-language pathologist working in a voice center will have acquired special training and knowledge in the field of voice beyond the typically required skills and knowledge of an SLP. That SLP may, however, not have any singing voice knowledge or experience. Certified SLPs may bill for services via standard health insurance policies.

Singing voice lies at the very edge of the scope of practice of a speech-language pathologist. As Schneider & Sataloff report, "if perceptually, the voice is within normal limits for the patient and is being produced in a reasonably efficient, nonabusive manner, then intervention by a speech-language pathologist need not be conducted. It is not within a speech-language pathologist's scope of practice to provide special training that develops range, power, control, stamina, and the esthetic quality required for artistic expression" (Schneider & Sataloff, 2007, p. 1133). Given that singing voice is not addressed in the typical education of an SLP and is rarely addressed in therapy, it makes sense that voice teams would look toward the singing pedagogy community for collaboration in the rehabilitation of singers. Singing teachers cannot bill health insurance for voice therapy, though. As part of a voice care team, singing teachers with a

strong background in voice science and experience in working with injured singers are indispensable in the rehabilitation of singers. They are usually called “singing voice specialists.”

Voice professionals find themselves in a unique situation, because there is no recognized training or accreditation for professionals who work in the rehabilitation of the singing voice. The solution that the field has in place now is that many voice professionals call themselves singing voice specialists, but there is no certification or educational process required to call oneself a singing voice specialist. “Singing voice specialists” are typically: singing voice teachers who have training/experience and knowledge of voice science and voice disorders or speech-language pathologists who have some background/training in singing. Increasingly, dual-trained speech-pathologist/voice pedagogues are working as “singing voice specialists,” “singing health specialists” or “clinical singing voice rehabilitation specialists.” Until the field clarifies and standardizes for the role of a “singing voice specialist,” (or singing health specialist, or whatever the field will decide to call this type of professional), it is up to the patient to determine the level of training of his or her therapist (Gilman et al., 2010). For the purposes of this section of the guide, I will use the term “singing voice specialist” to indicate a person who specializes in the rehabilitation of the singing voice.

A singing voice specialist should be an educator, trainer, problem solver, vocal counselor, and voice trainer across a wide range of styles. She or he should also be a liaison between the patient and the laryngologist, the patient and the voice scientist, the patient and the speech-language pathologist (unless the speech-language pathologist is also a singing voice specialist), and the patient and the voice teacher. The singing voice

specialist is very helpful to non-singers as part of an interdisciplinary rehabilitation (Radionoff, 2002). The singing voice specialist should not replace the patient's singing teacher, but should instead work with the teacher as a liaison between the voice team and the patient, the voice teacher, and others who may become involved to provide education, etc. In other words, the singing voice specialist complements the work that a singer is doing with his or her primary voice teacher and works as part of a team to assist in rehabilitation.

A singing voice teacher is expected to have an excellent knowledge of pedagogy for the habilitation of the healthy singing voice. That is, the singing teacher helps a person to achieve the highest possible level of function from his or her singing. The voice teacher should teach style, diction (in different languages for Classical singers) assign appropriate repertoire, have a basic knowledge of the anatomy and physiology of the voice, and refer a student in the case of vocal pathology (and be a communication partner for the other professionals on the voice care team). The singing voice teacher must have functional piano skills (better skills are most desirable) and an excellent knowledge of the style he or she is teaching. The teacher should have a significant performing background in the style he or she is teaching.

A singing voice coach works with singers to learn and perfect repertoire. He or she must have excellent piano skills and knowledge of style, diction, and the professional environment for whichever style of singing he is coaching.

Given a review of the available literature, the basic tools needed by singing voice specialists, speech-language pathologists, singing voice teachers, and singing voice coaches have been organized and summarized in Table 4.

Table 4. Tools Needed by Singing Voice Specialists, Speech-Language Pathologists, Singing Voice Teachers, and Singing Voice Coaches

Tool/ characteristic	Singing Voice Specialist	Speech- Language Pathologist	Singing Voice Teacher	Singing Voice Coach
Certification/ Degree	No certification or licensure. No specific degree required; degree in music or speech pathology preferred	Certificate of Clinical Competency through ASHA; Licensure through the state; MA, MS in speech-language pathology or PhD in Communication Sciences required	No certification, licensure or degree required	No certification, licensure or degree required
Code of Ethics	Not unless the SVS is a member of NATS or ASHA	Required	Not unless a member of NATS	Not unless a member of NATS
Professional background in singing	Strongly preferred	Not required	Strongly preferred	Not required, but often yes
Clinical (medical) experience including knowledge of vocabulary, instrumentation, procedures	Preferred (not officially required, but it would be impossible to do one's job without it)	Required	Not required	Not required
Special advanced training in voice science and voice disorders related to the singing voice	Preferred (unofficially required) with special emphasis on the singing voice	Not required; Voice training in SLP programs is usually limited to one graduate- level course regarding non- singing voice	Not required, but some teachers seek out this information or learn it in pedagogy coursework	Not required
Knowledge of technique for specific singing styles	Broad knowledge of a large range of techniques unofficially required	Not required	Teachers should have professional and pedagogical experience in the technique of specific genres they are teaching	Not required: singing voice coaches are not required to work on technique with clients

Table 4. (continued)

Tool/ characteristic	Singing Voice Specialist	Speech- Language Pathologist	Singing Voice Teacher	Singing Voice Coach
Knowledge of specific singing styles	Broad knowledge of singing styles unofficially required	Not required	Specific knowledge of style unofficially required	Specific knowledge of style unofficially required
Piano skills	Basic skills unofficially required	Not required	Basic skills unofficially required, advanced skills preferred	Excellent piano skills unofficially required
Knowledge of repertoire	Broad minimal knowledge unofficially required across genres	Not required	Genre-specific repertoire expertise unofficially required	Genre-specific repertoire expertise unofficially required
Length of relationship with singer	Short (weeks)	Speech-language pathologists do not usually work with singers unless they are singing voice specialists	Long course of study is standard (years)	Coaching schedules are usually scheduled in preparation for specific performances length of relationship can vary according to a singer's coaching needs (weeks – months – intermittent for years)
Ability to perform endoscopy	Not unless SVS is a speech pathologist	Yes (depending upon the state and supervision by physician)	No	No
Singing Pedagogy skills	Excellent skills unofficially required	Not required	Excellent skills unofficially required	Not required

For more detailed look at the voice care team, see Sataloff et al. “Voice Care

Professionals: A Guide to Voice Care Providers” in *Vocal Health and Pedagogy, Vol. 1*

(2006).

*Voice centers in the United States.* Before receiving treatment for a voice disorder, a singer should receive a comprehensive medical evaluation and diagnosis from an otolaryngologist. There are several voice centers specializing in the singing voice in the United States. Table 5 includes a list of some of the major voice centers in the United States that have special programs for singing voice. For further voice team locator information, see <http://www.uiowa.edu/~shevoice/locator.html> (accessed March 2, 2012). This website displays state-by-state information for voice teams that specialize in treating voice disorders. A note of caution: the site is not completely up to date, and not all centers specialize in singing or professional voice users.

Several of these voice centers have special programs for the assessment and treatment of the singing voice. One of the leading centers in this regard is the Duke Voice Care Center. Leda Scarce, MM, MS, CCC-SLP is a performing voice specialist and the director of the Performing Voice Programs and Development for the Duke Voice Care Center at Duke University Medical Center. She also serves as an adjunct assistant professor of the Practice of Music in the Duke University Department of Music. Scarce has created a program that focuses on high-level care of singers at the Duke Voice Care Center. What sets the program apart is that the voice therapists are dual-trained singing voice therapists (CCC-SLP) and professional singers and pedagogues with graduate level degrees in music. Leda Scarce makes sure that all therapists she hires are dual-trained or on the track to being dual-trained in the two areas.

Table 5. Voice Centers Specializing in Treatment of the Singing Voice

Center	Location	Website	Physicians	Singing Voice Specialist
Bastian Voice Institute	Downers Grove, IL	<a href="http://www.bastianvoice.com/">http://www.bastianvoice.com/</a>	Robert W. Bastian, MD Brent E. Richardson, MD	W. Nathan Waller, MM, MA, CCC-SLP
Blaine Block Institute for Voice Analysis and Rehabilitation: The Professional Voice Center of Greater Cincinnati and Cincinnati Head & Neck Surgeons	Dayton, OH	<a href="http://www.bbivar.com/index.php">http://www.bbivar.com/index.php</a>	Adan Fuentes, DO	Wendy DeLeo LeBorgne, PhD, CCC-SLP Stephen Gorman, PhD, CCC-SLP Catherine L. Ballif, MA, CCC-SLP Jennifer R. Reitz, MS, CCC-SLP Jennifer A. Keyes, MA, CCC-SLP
University of Cincinnati Voice Consortium: UC Health Voice & Swallowing Center	Cincinnati, OH	<a href="http://ent.uc.edu/patientcare/University%20Voice%20and%20Swallowing%20Center.html">http://ent.uc.edu/patientcare/University%20Voice%20and%20Swallowing%20Center.html</a>	Sid Khosla, MD Keith Wilson, MD	Eva van Leer, PhD, CCC-SLP
Cleveland Clinic: The Voice Center at the Head and Neck Institute	Cleveland, OH	<a href="http://my.clevelandclinic.org/head_neck/about/default.aspx">http://my.clevelandclinic.org/head_neck/about/default.aspx</a>	Tom Abelson, MD Michael Benninger, MD	Douglas Hicks, PhD Claudio Milstein, PhD
Weill Cornell Physicians Voice and Speech Disorders	New York, NY	<a href="http://www.weillcornell.org/practice/voicedorders/index.html">http://www.weillcornell.org/practice/voicedorders/index.html</a>	Lucian Sulica, MD	Thomas Murry, PhD

Table 5. (continued)

Center	Location	Website	Physicians	Singing Voice Specialist
Duke Voice Care Center	Raleigh-Durham, NC	<a href="http://www.dukehealth.org/services/voice_care_center/about">http://www.dukehealth.org/services/voice_care_center/about</a>	Seth Cohen, MD, MPH David L. Witsell, MD, MHS	Leda Scearce, MM, MS, CCC-SLP Caroline Banka, MS, CCC-SLP Hilary Caso Bartholomew, MS, CCC-SLP Emily Wolber, MEd, CCC-SLP
Emory Voice Center	Atlanta, GA	<a href="http://www.emoryhealthcare.org/voice-center/index.html">http://www.emoryhealthcare.org/voice-center/index.html</a>	Michael M. Johns III, MD Adam M. Klein, MD	Edie Hapner, PhD, CCC-SLP Marina Gilman, MM, MA, SLP
Jefferson Voice and Swallowing Center at Thomas Jefferson University Hospital	Philadelphia, PA	<a href="http://www.jeffersonhospital.org/departments-and-services/voice-swallowing-center.aspx">http://www.jeffersonhospital.org/departments-and-services/voice-swallowing-center.aspx</a>	Joseph R. Spiegel, MD Maurits S. Boon, MD	Rosemary Ostrowski, MM, MS, CCC-SLP Dan Sherwood, MS, CCC-SLP
Lakeshore Professional Voice Center, Lakeshore Ear, Nose and Throat Center	St. Clair Shore, MI	<a href="http://www.lakeshore.com/lent-procedures-voice.htm">http://www.lakeshore.com/lent-procedures-voice.htm</a>	Adam D. Rubin, MD	Cristina Jackson-Menaldi, PhD
Massachusetts Eye & Ear Infirmary (Work with Berkley and NEC)	Boston, MA	<a href="http://www.masseyandear.org/specialties/otolaryngology/voice-laboratory/">http://www.masseyandear.org/specialties/otolaryngology/voice-laboratory/</a>	Ramon Franco, Jr., MD	Keiko Ishikawa, MM, MA, CCC-SLP
Massachusetts General Hospital: Center for Laryngeal Surgery and Voice Rehabilitation	Boston, MA	<a href="http://www2.massgeneral.org/voicecenter/about/">http://www2.massgeneral.org/voicecenter/about/</a>	Steven M. Zeitels, MD, FACS	Tara Stadelman-Cohen, BMed, MS, CCC-SLP

Table 5. (continued)

Center	Location	Website	Physicians	Singing Voice Specialist
Mount Sinai Medical Center Eugene Grabscheid, MD Voice Center	New York, NY	<a href="http://www.mountsinaiifpa.org/patient-care/practices/otolaryngology---grabscheid-voice-center">http://www.mountsinaiifpa.org/patient-care/practices/otolaryngology---grabscheid-voice-center</a>	Kenneth W. Altman, MD, PhD	
New York University Voice Center	New York, NY	<a href="http://www.med.nyu.edu/voicecenter/">http://www.med.nyu.edu/voicecenter/</a>	Milan R Amin, MD	Ryan C. Branski, PhD, CCC-SLP Shirley Gherson, MS, CCC-SLP Carin Searby, MM, MS, CCC-SLP
NW Clinic for Voice & Swallowing at the Oregon Health & Science University	Portland, OR	<a href="http://www.ohsu.edu/xd/health/services/ent/services/nw-clinic-for-voice-and-swallowing/index.cfm">http://www.ohsu.edu/xd/health/services/ent/services/nw-clinic-for-voice-and-swallowing/index.cfm</a>	Joshua Schindler, MD Paul W. Flint, MD	Karen Drake, MA, CCC-SLP
The Voice Center at Ohio State University Medical Center	Columbus, OH	<a href="http://ent.osu.edu/about-the-department/divisions-and-specialties/laryngology-and-voice-center/">http://ent.osu.edu/about-the-department/divisions-and-specialties/laryngology-and-voice-center/</a>	L. Artick Forrest, MD Brad W. Desilva, MD	Kerrie Beechler Obert, MA, CCC-SLP Jennifer Thompson, MA, CCC-SLP
Peak Woo (Private Practice)	New York, NY	<a href="http://www.peakwoo.com/index.html">http://www.peakwoo.com/index.html</a>	Peak Woo, MD	
Performance Voice Solutions: A division of Northside ENT	Central Indiana	<a href="http://www.performancevoice.com/">http://www.performancevoice.com/</a>	Scott A. Hackett, MD, FACS	Rebecca Miles Risser, MM, MA, CCC-SLP
Philadelphia Ear, Nose & Throat Associates (PENTA) Drexel University Voice Center	Philadelphia, PA	<a href="http://www.phillyent.com">www.phillyent.com</a>	Robert T. Sataloff, MD, DMA, FACS Karen M. Lyons, MD	Margaret Barody, MM Julia Ellerston, MA, CCC-SLP Bridget Rose, MA, CCC-SLP

Table 5. (continued)

Center	Location	Website	Physicians	Singing Voice Specialist
Texas Voice Center	Houston, TX	<a href="http://www.texasvoicecenter.com/temp_orig/pro_care.html">http://www.texasvoicecenter.com/temp_orig/pro_care.html</a>	C. Richard Stasney, MD, FACS	Sharon Radinoff, MM, PhD Joyce Farwell, DMA Kim Wood Sharon
Tufts Medical Center for Voice and Swallowing	Boston, MA	<a href="http://www.tuftsmcdicalcenter.org/Our_Services/ENTOtolar yngology/The_Ce nter_for_Voice_an d_Swallowing">http://www.tuftsmcdicalcenter.org/Our_Services/ENTOtolar yngology/The_Ce nter_for_Voice_an d_Swallowing</a>	Thomas L. Carroll, MD	Jen Jackson, MA, CCC-SLP
University of California San Francisco Voice and Swallowing Center	San Francisco, CA	<a href="http://www.ucsfhealth.org/clinics/voice_and_swallowing_center/">http://www.ucsfhealth.org/clinics/voice_and_swallowing_center/</a>	Mark Courey, MD	Soha Al-Jurf, MA, CCC-SLP Sarah L. Schneider, MS, CCC-SLP
University of Kentucky Clinical Voice Center	Lexington, KY	<a href="http://ukhealthcare.uky.edu/voice/">http://ukhealthcare.uky.edu/voice/</a>	Sanford Archer, MD	Rita Patel, PhD, CCC-SLP Joseph C. Stemple, PhD, CCC-SLP Rebecca L. Hancock, Med, CCC-SLP
University of Michigan Health System Vocal Health Center	Livonia, MI	<a href="http://www.med.umich.edu/oto/vocalhealthcenter/">http://www.med.umich.edu/oto/vocalhealthcenter/</a>	Norman D. Hogikyan, MD, FACS	Marci Daniels Rosenberg, BM, MS, CCC-SLP Freda A Herseth, MM, DM Melody Lynn Racine Marc J. Haxer, MA, CCC-SLP
University of North Carolina Chapel Hill Voice Center	Chapel Hill, NC	<a href="http://www.med.unc.edu/ent/clinical-programs/voice-center-1">http://www.med.unc.edu/ent/clinical-programs/voice-center-1</a>	Robert A. Buckmire, MD Mark C. Weissler, MD, FACS	Ellen Markus, MA, CCC-SLP, DMA Linda F. Hube, MS, CCC-SLP
University of Pittsburgh Voice Center	Pittsburgh, PA	<a href="http://www.upmc.com/Services/Otolaryngology/ServicesandSpecialties/VoiceCenter/Pages/default.aspx">http://www.upmc.com/Services/Otolaryngology/ServicesandSpecialties/VoiceCenter/Pages/default.aspx</a>	Clark Rosen, MD Libby J. Smith, DO, FAOCO	Jackie Gartner-Schmidt, PhD Robert Fire, BFA, MM, AGMA, AEA Douglas F. Roth, MA, MM, CCC-SLP Tracey L. Thomas, MS, CCC-SLP

Table 5. (continued)

Center	Location	Website	Physicians	Singing Voice Specialist
University of Utah Voice Disorders Center	Salt Lake City, UT	<a href="http://utahhealthsciences.net/pageview.aspx?menu=2481&amp;id=8340">http://utahhealthsciences.net/pageview.aspx?menu=2481&amp;id=8340</a>	Marshall Smith, MD	Kristine Tanner, PhD, CCC-SLP Faye Muntz, MM
University of Washington, Department of Otolaryngology – Head and Neck Surgery	Seattle, WA	<a href="http://depts.washington.edu/otoweb/clinic_specialties/voice.htm">http://depts.washington.edu/otoweb/clinic_specialties/voice.htm</a>	Albert L. Merati, MD, FACS	Juli Rosenzweig, MS, CCC-SLP Pat Waugh, MS, CCC-SLP Ginger Hamilton, MS, CCC-SLP
University of Wisconsin Hospital Madison: Voice and Swallowing Clinic, Professional and Performing Voice Programs	Madison, WI	<a href="http://www.uwhealth.org/voice-swallow/voice-and-swallowing/11279">http://www.uwhealth.org/voice-swallow/voice-and-swallowing/11279</a>	Charles N. Ford, MD Seth Dailey, MD Timothy M. McCulloch, MD	Brian E. Petty, MA, CCC-SLP Emerald J. Doll, MS, CF-SLP
Vanderbilt Voice Center	Nashville, TN	<a href="http://www.vanderbilthealth.com/billwilkerson/26740">http://www.vanderbilthealth.com/billwilkerson/26740</a>	Robert Ossoff, MD C Gaelyn Garrett, MD Kim Vinson, MD	Thomas F. Cleveland, PhD Jennifer C Muckala, MA, CCC-SLP
Center for Voice and Swallowing Disorders of Wake Forest University Department of Otolaryngology: Wake Forest University Baptist Medical Center	Winston-Salem, NC	<a href="http://www.wakehealth.edu/Center-for-Voice-and-Swallowing-Disorders/">http://www.wakehealth.edu/Center-for-Voice-and-Swallowing-Disorders/</a>	S. Carter Wright, MD Catherine Rees Lintzenich, MD	

In fact, the Duke Voice Care Center defines singing voice specialists as “speech pathologists with extensive background in singing and vocal pedagogy” rather than singing teachers who have experience working with injured singers. (Leda Scearce, personal communication, February 17, 2012). Gilman et al. also support this definition (Gilman et al., 2010).

Most of the other centers listed above have a combination of speech pathologists and “singing voice specialists” of some sort. For example, Dr. Sataloff’s practice has a staff of dual-trained speech pathologists that work on speaking voice issues and a singing voice specialist, Peggy Baroody, who holds a MM in vocal performance and has trained thoroughly in clinical voice pathology. Emory Voice Center has a dual-trained speech pathologist/ singing voice specialist on staff, Marina Gilman, MS, MM, CCC-SLP. Some centers, like the Ohio State University Voice Center and the University of Michigan Health System’s Vocal Health Center, are interdisciplinary centers with experts from the departments of otolaryngology, speech pathology and vocal arts working together.

Some vocal health centers are based in the area of speech-language pathology for singers, but have connections to laryngologists for medical consultation when needed. An example of this type of center is The Chicago Center for Professional Voice. Karen Wicklund, DMA, MS, CCC-SLP, the director of the Chicago Center for Professional Voice, calls herself a “singing wellness specialist” and provides technique and wellness instruction for singers. The Chicago Center for Professional Voice and Dr. Wicklund also maintain a website for singers and professional voice users, [www.singershealth.com](http://www.singershealth.com), and provide educational workshops and consulting services for individuals, corporations,

healthcare organizations, and educational institutions in Chicago and throughout the world (<http://www.singershealth.com/ccpv.html>, accessed February 13, 2012).

Wendy LeBorgne has developed a new concept of the voice consultant at the Cincinnati Conservatory of Music. In this model, Dr. LeBorgne holds office hours and students can come to her to discuss vocal issues. Just like the departments of dance and instrumental music have a physical therapist for their students' physical injuries, so does the voice department. Dr. LeBorgne works with both the classical voice and the musical theater programs. She gives educational information regarding voice science and vocal health, and she takes diagnostic information on each student entering the voice program. This information includes a stroboscopic evaluation, acoustic analysis, and aerodynamic measures. Most importantly, it provides baseline information so that, in the event of vocal injury or complaints during the course of study, a student may be evaluated based on her original state and any abnormalities that were present may be noted as such during subsequent visit (Wendy LeBorgne, personal communication, November 20, 2012).

The Academy of the Vocal Arts employs the services of Dr. Sataloff's practice (literally around the block) as a vocal team for their singers. As in Cincinnati, all students are evaluated upon enrollment at Academy of the Vocal Arts and will be seen in the event of vocal disorder. Hopefully, more and more collegiate programs will follow suit, especially those schools that have speech and language centers on campus.

*Medical assessment of the singing voice.* Singers as a group require special services due to their high level of vocal use, especially when singing is part of a person's career. "The primary distinction between singers and other voice professionals is with

the artistic nature of their voices. In order to identify the needs of the professional singer and actor, it is important to understand the demands of vocal quality and artistic delivery. Singers...may be compared to professional athletes, who are more likely to suffer muscular injuries than the general population due to their high physical demand” (Behlau & Murry, 2006). When seeking a voice assessment at a voice center, a singer can expect to undergo a full evaluation with the interdisciplinary team prior to receiving any treatment for his or her voice disorder. See [ncvs.org/e-learning/expect.html](http://ncvs.org/e-learning/expect.html) for more information on what to expect at a voice center visit. Usually, once a singer has decided to seek medical attention for a voice problem, medical professionals understand the gravity of the situation. “Professional voice users as a group have the highest of work ethics and an unusually good appreciation of their state of health. They generally will not seek out the help of a laryngologist unless they are certain that something specific is wrong with their vocal tract; their level of anxiety as to its ramifications on their career will be great, and they will likely downplay the extent of the ailment and its duration” (Rubin et al. Chapter 40, 2006, p. 638).

Most voice centers assess voice by taking a detailed case history, directly evaluating the larynx via endoscopy (visualization of anatomy) and stroboscopy (function and movement of the mechanism), perceptual assessment of the voice by the clinician, quality of life measures by the patient (using the Singing Voice Handicap Index), reflux symptoms (using the Reflux Severity Index), acoustic measures (S:Z ratio, maximum phonation time, MDVP [perturbation measures], voice range profile, average pitch during comfortable /a/ and conversation) and aerodynamic measures (subglottal pressure and airflow measures).

According to an informal survey of speech pathologists from major voice centers (personal communications, 2012), the main differences in the assessment of singers versus non-singers are the type of questions asked in the case history, the thoroughness of the voice range profile, and the scope of the perceptual assessment. During the assessment, patient history information should include information about practice habits, warm-ups, travel schedule, vocal load, nutrition and eating schedule, sleep schedule, hydration and hygiene. Nonmedical issues could include family trouble, trouble with a singing coach or teacher, trouble with a producer or colleagues, and/or difficulty with a particular role or type of singing. For significant psychological singing issues, referrals may be made to a vocal psychotherapist. Diane Austin, director of the Music Psychotherapy Center in New York is an excellent reference (see [www.psychodramany.com/diane/](http://www.psychodramany.com/diane/) for more information).

Environmental considerations at performing venues and vocal load should be seriously considered. It should be known that professional voice users often self-medicate, and even use their colleagues' medication, sometimes incorrectly. This can be dangerous and should be looked out for and educated against by the voice team. During the evaluation, it is ideal for a patient to view a recording of the laryngeal exam in order to understand the larynx, see the pathology or lack of pathology, and to cause the performer to feel involved. If possible, a video of the singer giving a performance should be reviewed by the voice care team to determine vocal habits while singing in a professional environment. Specific evaluation procedures for singers may be found in "Acute Assessment of Professional Singers" (Schlömicher-Their & Weikert, 2006), "The

Singing Voice Specialist” (Sataloff et al., 2006), Sataloff (2005), Rubin et al. (2006), and Titze & Verdolini (2012).

*Therapy for the singing voice.* When considering treatment, laryngologists understand the performers cannot afford to have negative repercussions from treatments. Schlömicher-Their & Weikert (2006, chap. 13) and Benninger & Murry (2006, pp. 139-149) offer a good review of the treatment of singers in acute situations. These situations occur when a singer has an obligation to perform and a voice team must make the decision of diagnosis and whether or not a singer should be performing. “Professional singing must be regarded as a high-performance sport; it requires special training conditions and top physical performance...In case of illness, a variety of individual factors arise. The decision to recast is made more difficult by responsibility toward the other members of the cast, anxiety on the part of the management, exertion of influence by the conductor and the director; recording contracts are tempting, and – last but not least – the audience wishes to see a radiant hero or heroine” (Rubin et al, 2006, p. 642). The physician must protect the singer from further damage and devise a treatment plan that will enable the patient to make the fullest use of his or her voice in the shortest possible amount of time. Therefore, sprays, corticosteroids, surgery, etc. are all prescribed with great caution. Behavioral therapy is the best option for professional voice users whenever possible. See Stemple et al. for a more detailed survey of voice management (Stemple et al., 2010, pp. 193-298).

“The ideal situation for most singers with a vocal injury is to take part in a voice therapy program that includes vocal education, psychodynamics, and voice training with

the help of a singing specialist” (Behlau & Murry, 2006, p. 182). In fact, vocal rehabilitation is usually the preferred treatment for benign lesions (rather than surgery) in singers (Behlau & Murry, 2006 p. 192). For specific exercises, see: Carroll (2006), Behlau (2005), Sataloff et al. (2006, chapter 23), Sataloff (2005), and LoVetri (2006). In her chapter “Treatment of injured singers and professional speakers: The singer/actor, singer/dancer, and singer/musician,” Jeannette LoVetri explains specific risk factors of singing actors, dancers and musicians (2006). She then explains, “Many of the same principles that apply to working with a disordered or injured speaking voice also apply to working with the voices of those who sing. The primary difference is that the exercises are applied to pitches that are specific (musical scales and arpeggios) and often sustained for longer durations and at louder volumes than necessary for conventional speech” (LoVetri, 2006, p. 214). She suggests beginning with exterior structures to adjust posture, breathing, and the musculature of the face and head. Next, internal structures and emotional issues are explored. Behlau & Murry suggest using a dimension of vocal analysis that encompasses options of respiratory, vocal, articulatory, psychodynamic, and behavioral parameters used by both the individual and by the group in which he or she fits (Behlau & Murry, 2006, p.179).

Approaches to voice therapy that may be used in addition to singing voice therapy include: confidential voice therapy (using breathy, soft, gentle technique of speech), resonant voice therapy (gentle vocal fold contact/ flow phonation), accent method (accented and rhythmic alterations in pronunciation and related body movements), circumlaryngeal massage (massaging the muscles of the neck to reduce tension), Alexander Technique (promotes ease and freedom of movement, balance, support,

flexibility, and coordination) and Feldenkrais Technique (combines martial arts, psychology, biomechanics, and motor development principles to improve posture, movement, flexibility, coordination, and self-image) (Sataloff, 2005, pp. 20-22). See Stemple et al. for supportive training and techniques, including: Alexander Technique, The Linklater Method, the Feldenkrais Method, the Lessac System, and Estill Voice Training (Stemple et al., 2010, pp. 320-323).

*Vocal habilitation vs. vocal rehabilitation.* Although there is much overlap in the general techniques and principles behind both practices, training an injured voice (vocal rehabilitation) is different from the training that occurs in basic singing voice pedagogy (vocal habilitation). The two disciplines vary in three main ways: the assumed background knowledge of the pedagogue/clinician, working inside or outside a medical setting, and the goals and expectations of restoring a lost function versus building a technique within a healthy system.

In vocal rehabilitation settings, voice therapy services must be provided by or in coordination with a certified speech-language pathologist (i.e. someone with a MA or MS in speech pathology who is licensed and has their certificate of clinical certification) with a specialization in voice or a singing voice teacher who is a singing voice specialist working in coordination with a certified speech language pathologist who is treating the speaking voice of the patient. For the speech pathologist, then, the patient understands the background that the therapist has because the education is monitored by ASHA and there are specific standards that each speech pathologist must show competency in before receiving membership in ASHA. There is also a code of ethics that the speech

pathologist is bound by as a medical professional. The speech-language pathologist also has training in the use of evidence-based practice, which is the use of current research as the basis for therapeutic assessment and treatment strategies. That being said, as mentioned above, master's programs for speech pathologists include very little to no training regarding professional voice users, and even less regarding professional singers. Therefore, it is up to the patient to determine whether or not the specific therapist has the appropriate background to work with the singing voice.

While some voice teachers may have all training necessary to work with injured singers, there is no certificate or license issued to document the training of a voice teacher. In light of this situation, a client cannot assume any level of training from someone who calls him or herself a voice teacher. This is a major reason why a certificate recognized by ASHA and NATS would be so helpful for the field.

Vocal rehabilitation occurs in coordination with a medical voice team. This leads to major deviations from the voice studio in access to medical diagnoses, professionals and equipment, insurance issues, documentation, and the length of the course of therapy. Access to medical equipment and diagnoses may greatly alter the course of treatment. “A singing voice specialist should never work with a patient without a comprehensive medical examination and diagnosis from an otolaryngologist” (Sataloff et al., 2006, p. 273). The singing voice specialist working within a medical setting has access to and understanding of the full evaluation (including laryngeal imaging) of a patient and the informed diagnosis of a trained laryngologist. She or he also has access to medical instrumentation to do follow-up measures and to provide biofeedback to a patient during therapy. (This instrumentation is sometimes, but usually not available in voice studios.)

Guided by the voice team, the singing voice specialist will participate in making informed decisions regarding whether a singer should begin therapy or stay on vocal rest, the goals of the therapy, and the specific training program. Singing voice specialists will have to document baseline information and progress using perceptual and objective measures. This is not required of a voice teacher. The documentation created by the speech pathologist may be used for billing purposes for insurance companies. To that end, singers who are receiving voice therapy through their insurance providers may be limited to a specific number of therapy sessions. Singers who are working with a singing voice specialist who is not a speech pathologist do not qualify for services billed through insurance and must pay their provider out of pocket.

The length of rehabilitation is intentionally quick. Whereas the length of study of a singer with a voice teacher is usually intended to last for several years, on average, the length of rehabilitation is intended to be as efficient and as effective as possible, sometimes lasting as few as two-three sessions or, more typically, six-eight sessions. Of course, singers are encouraged to follow-up with their therapists to ensure that the gains have been maintained. As a result of these medical factors, the goals of voice therapy are quite different from the goals of voice habilitation.

The goals of voice therapy include working with the speaking and the singing voice to ensure proper technique and carryover from exercises to everyday use. In voice therapy, the clinician is working with the whole voice, not just the singing voice (as is typically the case in voice lessons). The main difference from singing voice lessons is that the clinician needs to help establish healthy phonation patterns for a person who has an existing vocal pathology, not a healthy singer. This should be achieved through the

tri-fold approach of vocal education, psychodynamics and voice training (Behlau & Murry, 2006, p. 182). The clinician must manage his or her expectations, “In many instances, the singing voice specialist must be disciplined enough to ignore vocal quality, and to train the patient to practice appropriate techniques regardless of the sound...One of the most important aspects of training for a singing voice specialist is developing the ability to understand medical limitations, goals, prognosis, and expected duration of recovery (often months)” (Sataloff et al., 2006, II, pp. 282-283). Linda Carroll comments that a clinical voice rehabilitation professional must exercise exceptional judgment when assigning exercises and must instruct the patient appropriately in order to avoid further injury. “Vocal exercises should be prescribed in an organized manner, with rationales and expected results (or gains) for each exercise. If the patient does not understand the specific need for each exercise, he or she may misjudge when to use the exercise, or may misjudge the production found during the exercise” (Rubin et al., 2006, p. 602).

While repertoire may be used in voice therapy, it is primarily the job of the singing voice teacher to assign and work on repertoire and style and to continue to maintain and build technique (habilitate the singer) once the singer has been released from voice rehabilitation. The singing teacher continues to work on technique while, if available, a vocal coach supplements work on diction and style. While the healthy voice production is the primary goal of the voice therapist, optimal voice production in all aspects of style is the goal of the singing teacher and coach. A student should expect a professional background in the genre of study from his or her teacher and excellent piano skills from a coach. While a singing voice specialist should have suitable piano skills and

knowledge of a range of voice types, she is not required to have specialized knowledge in either of these areas.

*Primary vocal pathologies in singers.* Since professional voice users, and especially singers, need to have optimal use of their vocal tract, it is imperative that they be educated regarding vocal health and hygiene and the function of the vocal system. Lack of a solid knowledge of one's instrument could lead to vocal problems. "We find only a few professional voice owners who have even a vague awareness of the anatomy and physiology of the vocal mechanism. Although many people possess "trained voices"...other vocal misuses and abuses are often present as primary causes of their vocal difficulties" (Stemple et al, 2010, p. 303). Education regarding vocal health includes the primary vocal pathologies encountered by singers, vocal hygiene tips, and alternative and augmentative treatments.

The primary functional vocal pathologies (those caused by improper or excessive voice use) encountered by otherwise healthy singers are: non-infectious laryngitis, vocal nodules, Gastroesophageal Reflux Disease (GERD)/Laryngopharyngeal Reflux (LPR), muscle tension dysphonia, vocal fold hemorrhage/vascular pathologies, vocal polyps, vocal cysts, sulci, and contact ulcers/granulomas. These pathologies are reviewed in great detail in many sources, some of which include:

McCoy 2004, McCoy, S. (2004). *Your voice: An inside view*. Princeton, NJ: Inside View Press, 158-174.

Sataloff, R.T. (2006). Common medical diagnoses and treatments in patients with voice disorders: Introduction and overview. In R.T. Sataloff (Ed.), *Vocal Health and Pedagogy, Vol II*. (pp. 1-16). San Diego, CA: Plural Publishing.

Stemple, S., Glaze, L., & Gereman, B. (2010). *Clinical voice pathology: Theory and*

*Management, 4<sup>th</sup> Edition*. San Diego, CA: Singular Publishing Group.

Titze, I. & Verdolini, K. (In preparation). *Vocology*.

Titze, I. R. (2000). *Principles of voice production*. Iowa City, IA: The National Center for Voice and Speech.

Woo, P. (2006). Laryngeal examinations and visualizations. In M. Benninger & T. Murry (Eds.), *The performer's voice* (pp. 73-89). San Diego, CA: Plural Publishing.

Gastroesophageal reflux disease (GERD) and its affect on singers is a complex issue and is “probably the most underdiagnosed and most common gastrointestinal problem that affects professional voice users” (Stemple et al., 2010, p. 315). Professional singers often engage in behaviors that promote reflux, such as eating large meals after periods of low food intake, eating highly-acidic foods, stress, poor sleep habits. The deep breathing with singing could also interfere with lower esophageal sphincter function. The tissue of the larynx may be affected, and the vocal folds may appear edematous or erythematous. The amplitude of the vibration of the vocal folds may be mildly to severely decreased as a result. For more detailed information, see:

Merati, A.L. (2006). Reflux and the performer's voice. In M.S. Benninger & T. Murry (Eds), *The performer's voice* (117-130). San Diego, CA: Plural Publishing. (Includes an excellent bibliography on the subject of reflux and the performer's voice. The article is specific to singers.)

Sataloff, R.T., Castell, D., Katz, P. & Sataloff, D. (2006). *Reflux Laryngitis and related disorders, 3<sup>rd</sup> Edition*. San Diego, CA: Plural Publishing.

[www.performancevoice.com/category/reflux-symptom-index/](http://www.performancevoice.com/category/reflux-symptom-index/) (Accessed February 5, 2012)

*Vocal health and hygiene*. It is very important for singing voice specialists to educate patients and singers, voice teachers and music educators (among others) about the importance of vocal hygiene in the prevention and healing of vocal pathology.

Education should include common vocal hygiene concerns for singers, and general resources for vocal health. Singers are an “at-risk” population due to the high demands they place upon their voices (Stemple et al, 2010, pg. 302). Therefore, singers must also know when to refer themselves or their students to a medical voice center for evaluation. In that regard, singers may find the chapter from Davies & Jahn (2004) “A Singer’s Guide to Self-Diagnosis” to be very helpful. In the chapter, Davies & Jahn educate singers regarding the warning signs of mucosal injuries (those injuries which are most common to singers: vocal fold nodules, hemorrhages and vascular lesions, polyps and cysts). The warning signs include, but are not limited to increased effort and loss of endurance in singing; increased difficulty with rising fundamental frequency (pitch); breathiness, air leakage and respiratory overdrive; day-to-day variability in vocal ability; high pitched ‘squeals’ (caused by dampened oscillation at the site of stiffness and denotes segmental vibration of the vocal folds) especially in coordination with reduction of the normal upper register; hoarse, harsh, raspy, gravelly quality; vibrato instability; and development of compensatory behaviors (i.e. greater muscular effort). Singers should be able to sing staccato, legato, and with a full range of dynamics with accurate articulation. An inability to perform these tasks could indicate vocal swelling or other pathology. Specifically, singers who cannot perform tasks quietly, who experience increased breathiness with increased frequency, or who experience delayed phonatory onsets for a period of at least two weeks in the absence of any other disease should seek a consultation with an ENT (Davies & Jahn, 2004, pp. 125-137).

Important aspects of vocal health include preventive measures, including moderation (learning to pace and not overuse the voice) (Scarce, 2010). Other measures

include proper hydration, nutrition, exercise and sleep. Also, allergens and environmental toxins should be understood and limited/eliminated, if at all possible.

For more information see:

Sataloff (2006), *Vocal Health and Pedagogy, Vol II: Advanced assessment and practice*. Select chapters:

Cohn, J.R., Adams, P., Hawkshaw, M.J. & Sataloff, R.T. Allergy, p. 49

Harvey, P.L. & Miller, S.H. Nutrition and the professional voice, p. 99

Harvey, P.L. & Saxon, K. Sleep and the vocal performer, p. 121

Davies & Jahn (2004), Chapter 11.

*Drugs.* Vocologists should have a basic knowledge of drug effects that may be desirable or undesirable for the voice (Titze & Verdolini, 2012). “Many factors (such as age, gender, body composition, metabolism, and concurrent administration of other medications) can influence a person’s response to a medication(s)” (Stemple et al, 2010, p. 311). Effects may occur from over-the-counter, prescription, illicit/recreational (including alcohol and cigarettes) drugs. Possible effects of drugs can include drying of the vocal folds or vocal tract, throat irritation, cough, hoarseness, voice changes. For example, antihistamines have a drying effect of mucous membranes and may cause some of these effects. Nonsteroidal anti-inflammatory drugs (like ibuprofen) decrease platelet function and could increase a person’s chances of incurring a vocal fold hemorrhage during times of strenuous voice use (Titze & Verdolini, in preparation). Also, Alcohol “is abusive both as a local oral and laryngeal irritant and as a vasodilator of the mucosal

lining of the mucosal lining of the larynx...Caffeine is also a vasodilator and has a dehydrating effect on the mucosal membrane” (Stemple et al., 2010, p. 312).

Alessi, D.M. & Crummey, A. (2006). Medications: The positive and negative impact on voice. In M. Benninger & T. Murry (Eds.), *The performer’s voice*. San Diego, CA: Plural Publishing.

Branski, R. (January, 2012). Voices of Broadway. *NYU Voice Symposium Presentation*.

Davies, D.G. & Jahn, A.F. (2004). *Care of the Professional Voice: A Guide to Voice Management for Singers, Actors and Professional Voice Users*. New York: Routledge, Inc.

Harris, T.M. & Rubin, J.S. (2006). Medications and the Voice. In M. Benninger. & T. Murry (Eds.), *The performer’s voice*. San Diego, CA: Plural Publishing.

Sataloff, R.T., Hawkshaw, M.J. & Anticaglia, J. (2005). Medications and the Voice. In R.T. Sataloff (Ed.), *Treatment of Voice Disorders*. San Diego, CA: Plural Publishing.

Titze, I. & Verdolini, K. (2012). *Vocology*. In Press.

For a listing of medications and effects on voice, see:  
<http://www.ncvs.org/rx.html> (Accessed December 20, 2012)

*Hormones and aging.* The complex hormonal system in the human body, monitored by the brain, the hypothalamus, and the pituitary gland, has great implications for singers. The larynx is a hormonal target, and the ever-changing hormonal balance of a person’s body has been proven to have significant effects on the voice (Abitbol, 2006). The effects of hormones are exaggerated during puberty for both males and females, during the course of the menstrual cycle, pregnancy, and menopause for females, and during aging for both sexes. In fact, during menstruation changes in vocal fold vibration regularity during the menstrual and follicular phases of the cycle exist, and singers seem to compensate for these effects to avoid intonation difficulties caused by hormonal

variations (Lã, 2010). For more information on hormones and the voice see the following sources (Vigil, 2011):

Abitbol, J., Abitbol, P. & Abitbol, B. (1999). Sex Hormones and the Female Voice. *Journal of Voice*, 13(3), 424-446.

Abitbol, J. (2006). Normal Voice Maturation: Hormones and Age. In Benninger, M.S. & Murry, T., Eds. *The performer's voice*. San Diego, CA: Plural Publishing, 33-50.

Awan, S.N. (2006). The aging female voice: Acoustic and respiratory data. *Clinical Linguistics & Phonetics*, 20(2), 171-180.

Davies, D. Garfield, and Anthony F. Jahn. (2005). *Care of the Professional Voice: A Guide to Voice Management for Singers, Actors and Professional Voice Users*. New York: Routledge, Inc.

Hirano, M., Kurita, S, & Sakaguchi, S. (1989). Aging of the vibratory tissue of human vocal folds. *Acta Otolaryngol*, 107.

Lee, R. & Hopkins, V. (1996). *What your doctor may not tell you about menopause*. Boston: Warner Books.

Linville, Sue Ellen. (2001). *Vocal Aging*. San Diego, CA: Singular/Thomson Learning.

Sataloff, Robert T. (1996). Laryngoscope: The Effects of Menopause on the Singing Voice. *Journal of Singing*, 52(4), 39-42.

Sataloff, R.T. & Linville, S.E. (2006). The effects of age on the voice. In Sataloff, Ed. *Vocal Health and Pedagogy: Advanced assessment and treatment, Vol. II*. San Diego, CA: Plural Publishing.

*Complementary and alternative medications and techniques.* Homeopathic health and wellness for singers is another field that can aid in prevention and rehabilitation of singers. Complementary and integrative medicine (CIM) “is defined as any practice that can be used for the prevention and treatment of diseases, but not taught widely in medical schools, not generally available in hospitals, and not usually covered by health insurance. Similarly, Andrew Weil, MD, defines integrative medicine as a healing-oriented

medicine that draws upon all therapeutic systems to form a comprehensive approach to the art and science of medicine” (Seidman, 2006, p. 163). Singers are generally more open to the idea of CIM than the typical person, with about 70% of singers already using CIM therapies (Seidman, 2006, p. 163). CIM therapies work towards prevention and wellness rather than reacting to a disease. When considering the mind-body-spirit construction of the human being, it is impressive to note that 99% of the funding for conventional western medicine goes toward the treatment of the body, rather than the mind or the spirit.

In a holistic model, body, mind and spirit are equal and inseparable from each other. In disease states, there is an imbalance of the three parts of the human being. The three parts (body, mind and spirit) should be treated together equally in this model. Therapies include acupuncture, Alexander Technique, biofeedback, chiropractic, energy healing, Feldenkrais Technique, folk remedies, homeopathy, herbal supplements, hypnotherapy, imagery, magnet therapy, massage therapy, megavitamin therapy, naturopathy, prayer, reflexology, relaxation, remote healing, rolfing, self-help groups, spiritual healing by others, therapeutic touch.

See Stemple et al. (2010) for a guide to “supportive training and techniques” including Alexander Technique, The Linklater Method, Feldenkrais Method, and The Lessac System. A guide to herbs used for medicinal purposes, complete with indications, actions, contraindications, side effects, interactions, and dosages is presented in Seidman (2006, pp. 167-169). A lack of randomized, double-blind, placebo-controlled studies supporting the efficacies of these therapies leads to a dearth of evidence base for the

therapies. Therefore, many clinicians are hesitant to recommend these treatments (Seidman, 2006).

Rubin, J.S., Blake, E. & Mathieson, L. (2006). The effects of posture on voice. In Rubin et al, Eds. *Diagnosis and Treatment of Voice Disorders*. San Diego, CA: Plural Publishing.

Seidman, M. (2006). Complementary and alternative medications and techniques. In Rubin et al. (Eds.), (pp. 163-176). *Diagnosis and Treatment of Voice Disorders*. San Diego, CA: Plural Publishing.

Titze, I. & Verdolini, K. (In preparation). *Vocology*.

Wicklund, K. <http://www.singershealth.com/dimensions/herbs.html>. Accessed February 21, 2012.

For herbal and vitamin regimens for singers, see: <http://www.ncvs.org/rx.html>.

There are many general resources for vocal health available to singing voice specialists and to patients and singers for both preventative and rehabilitative educational purposes. [www.singershealth.com](http://www.singershealth.com) is a vocal health website maintained by Karen Wicklund at the Chicago Center for Professional Voice. “*Singershealth.com* is a comprehensive source of singers health information, where you will find timely references regarding all aspects of singers' wellness, and onsite wellness services for your singers” ([singershealth.com](http://singershealth.com), accessed January 30, 2012). Specific topics include physical, emotional, mental, social, occupational, spiritual, physical-vocal and technical-vocal health. Of note is the singer's wellness model questionnaire of 240 questions that Dr. Wicklund uses during her on-site testing of singers.

## CHAPTER 4: EDUCATIONAL OPPORTUNITIES

Training to become a singing voice vocologist requires knowledge and experience in the fields of vocal performance, pedagogy and voice therapy. The singing voice vocologist, therefore, requires interdisciplinary training in the fields of vocal performance, vocal pedagogy and clinical speech-language pathology. (See Chapter Three for required skills of a singing voice specialist.) In this chapter, the various opportunities for training will be explained, including: university training programs, private training programs and mentorships, professional organizations, recommended reading, conferences, and vocal training across genres.

*History of the development of training programs.* The primary issue in the training of singing voice vocologists is that there are no guidelines or accredited certifications for those wishing to become a singing voice vocologist acknowledged by the governing bodies in the fields of speech language pathology and vocal pedagogy (ASHA or NATS). Since the field has not outlined what is required of a singing voice vocologist, it is difficult to organize a training program that promises to be comprehensive in the training of such professionals. It is important to keep in mind that there is also no agreed-upon name for the professional who specializes in the clinical rehabilitation of the singing voice. Some options include: singing voice specialist (most commonly used in the field currently), singing health specialist, vocologist, and clinical singing voice rehabilitation specialist. As a result of this overall situation, there are very few organized educational opportunities for singing voice vocologists and most of the

organized programs for singing voice vocologists are new within the last ten years. This is not for lack of effort.

For about 30 years (since 1984), leading scientists and physicians in the field of vocology have been attempting to create a unified training program for professionals who are seeking to gain expertise in the rehabilitation of the singing voice (Radionoff, 2004). This endeavor began to garner serious attention with the 1991 proposals for training programs by Ingo Titze, PhD and Robert Sataloff, MD, DMA at the annual Voice Foundation Symposium. Titze proposed a vocology track to provide specialized courses in addition to the standard coursework for interested MA SLP students at the University of Iowa. This program would provide specialized education in vocal anatomy and physiology, instrumentation, medical applications and vocal performance and pedagogy. The program has since come to fruition at the University of Iowa and the Summer Vocology Institute (see below). At the same Voice Foundation symposium, Dr. Sataloff proposed a PhD in Arts Medicine, a broad field, with concentrations in the voice, the hand, dance and other related fields. In the voice concentration of this degree, applicants would already hold a master's or doctoral degree in a related discipline, such as speech-language pathology, vocal pedagogy, or medicine. Throughout the degree, the students would become experts in their field by pursuing advanced classroom and clinical coursework and pass a final examination:

This shall include (a) a written examination including basic science, research methods, speech pathology relevant to voice, medical care of professional voice users, clinical sciences, and singing methods and pedagogy of speech and singing; (b) an oral examination including, but not limited to, performance of a complete laryngological examination, visualization of the vocal folds and interpretation of laryngoscopic images, interpretation of objective, clinical measures of voice and pulmonary function, analysis of the singing techniques of beginning, intermediate, and advanced singers, and analysis of speaking voice techniques; and (c)

presentation of a public solo performance or an approved public performance as a singer or actor. A solo recital will be required in most cases (Sataloff, 1992).

Sataloff's program, although thorough and seemingly appropriate and beneficial for future voice rehabilitation professionals, has not been implemented.

Until 2002, there remained no specific programs designed to train singing voice specialists, and apprenticeship and observation were the only forms of training. Furthermore, fewer dual-trained professionals in the fields of speech pathology and vocal pedagogy existed at that time. This had an effect on the expectations and general understanding of a singing voice specialist. In 2002, for example, Heman-Ackah et al. defined the singing voice specialist as "a singing teacher with special training equipping him or her to practice in a medical environment with patients who have sustained vocal injury," highlighting the lack of clear qualifications of a singing voice specialist and limiting the professional to the confines of a singing teacher (Heman-Ackah et al, 2002). In her contemporaneous article, Radionoff expressed the changing status and increasing expertise of singing voice rehabilitation professionals, stating:

Now in 2003...the need is greater than ever for some type of degree plan or certification to prepare a person who aspires to be a singing voice specialist. As more clinics emerge and more people become interested in the field of Arts Medicine, it is crucial that there are appropriate means and standards for preparation (Radionoff, 2004).

Radionoff proposed her own plan for the educational program of a singing voice specialist, which has not been adopted at the university level. In 2006, Sataloff et al. commented on the ongoing situation: "At present, there are no formal training programs in the United States that teach singing teachers to work with injured voices" (Sataloff et al., 2006, p. 273).

To address the issues, ASHA, NATS and VASTA issued the following statement in 2006 regarding training of professionals who plan to work with professional voice users.

Although ASHA, NATS, and VASTA recognize the differences in both professional preparation and in the primary goals of their respective membership, all three organizations acknowledge the need for broader, interdisciplinary training of speech-language pathologists, teachers of singing, and voice and speech trainers who plan to work with professional voice users. The following general guidelines are recommended:

- 1) The preparation of the speech-language pathologist who works with singers, actors, and other professional speakers (e.g., clergy, politicians, teachers, and radio and television announcers) needs to be augmented to include instruction in voice pedagogy (the art and science of teaching voice) and vocal performance to develop both the singing voice and speaking voice to optimum levels of health, performance, and artistry.
- 2) The preparation of the teacher of singing needs to be augmented in a comparable manner to include training in anatomy and physiology, behavioral management of voice problems, development of the speaking voice, and the singing teacher's role in working with the speech-language pathologist and the physician in the medical management of voice disorders.
- 3) Similarly, the preparation of voice and speech trainers who work with singers and other professional speakers needs to include instruction in anatomy and physiology, behavioral management of voice problems, singing pedagogy and performance, and the voice and speech trainer's role in working with the speech-language pathologist and the physician in the medical management of voice disorders.

ASHA, NATS, and VASTA mutually affirm that the following areas remain the province of our individual organizations to act upon as desired: (a) the development of more specific training requirements for individual members who elect to work with speakers and singers with voice disorders; (b) the development of criteria for evaluation and subsequent recommendation and/or accreditation of training programs; and (c) the development of criteria for identification and/or certification of individual members who obtain the recommended specialty training (ASHA/VASTA/NATS, 2006).

The goals of this ASHA/NATS/VASTA statement have yet to be achieved in full. Since 2006, several degree plans have come about have come to fruition for training future vocal health rehabilitation professionals. These programs, however, do not have uniform

requirements and standards of training. The problem remains: **the field needs to establish certification requirements for specialty training.**

Perhaps one of the issues preventing the development of these criteria for certification is disagreement among professionals and disciplines regarding the level to which a singing voice vocologist must train in the areas of voice performance, voice pedagogy and voice therapy. Some clinicians working with injured singers are dual-career speech pathologists and singing voice pedagogues. These professionals are rare, but are becoming more common. Other professionals calling themselves “singing voice specialists” are single-trained voice pedagogues or speech-language pathologists with add-on (as opposed to full) training in their secondary field.

Some experts, like Leda Scarce, MM, MS, CCC-SLP of the Duke Voice Center, believe that singing voice vocologists should have full dual training in the fields of voice pedagogy and speech-language pathology. In other words, therapists working with singers in a medical/rehabilitative setting should have the equivalent of a master’s of music in vocal pedagogy/performance and a master’s in speech-language pathology. Scarce takes the role of the singing voice therapist very seriously at the Duke Voice Center and holds the clinician to a high standard that should be compensated for monetarily within a voice center. These specialized clinicians should hold a title of Clinical Singing Voice Rehabilitation Specialist (Leda Scarce, personal communication, February 17, 2012). By having a dual-trained individual, the issues of scope of practice diminish at the medical level. For example, Stemple et al. describe the issue that arises around single-trained professionals:

    Treating voice and speech disorders has legal implications and requires a master’s degree in speech pathology, as well as a license and certification. Similarly, voice

pathologists are not trained to teach singing or acting; therefore, it is necessary to work together to achieve the professional goals in vocally rehabilitating the performer” (Stemple et al., 2010, p. 302).

When a person is a dual-trained specialist, the speech-language pathologist and vocal pedagogue is the same person, and can therefore care for the singer in one therapeutic session confidently, comprehensively, and without negative legal implications.

On the other hand, some leaders in the field believe that singing voice rehabilitation specialists can successfully train by supplementing singular training (i.e. full training as a speech-pathologist or a singing voice pedagogue) with additional, limited “add-on” coursework without striving for full dual-training. These professionals would therefore be able to provide better informed services than solely singularly-trained professionals, but would still be bound to their primary domain of speech-language pathology or vocal pedagogy. The benefits of add-on training are significantly less cost and time of education for the individual professional and increased teamwork among professionals because of more narrow competencies for individual practitioners. The cons of singular training are that the therapist, who is legally responsible for vocal rehabilitation, does not have a thorough understanding of vocal pedagogy and the vocal pedagogue does not have a thorough understanding of the medical implications surrounding vocal rehabilitation and speech-language pathology.

*University training programs.* Currently, “singing voice specialists” are completing training by either attending two separate programs (one in vocal pedagogy and one in speech pathology) to become dual-trained professionals or fulfilling single training in either vocal pedagogy or speech-language pathology with add-on programs in

the secondary area of specialization. The official add-on programs exist at the university level in the fields of speech pathology and vocal pedagogy and are described below.

The Singing Health Specialization at the Ohio State University is an interdisciplinary add-on program focused on the care of the professional voice. The program comprises lectures, seminars, clinical observations, and lab practicum courses taught by specialists from the school of medicine (department of otolaryngology), school of music (voice and pedagogy) and department of speech and hearing science. Students may take the course in addition to the master's degree in voice performance or speech-language pathology or as part of the DMA in voice performance or PhD in Speech and Hearing Science. The specialization is currently 23-hours (quarter hours, not semester hours) and can be completed within the standard timeframe of the degree program. Students in the specialization program complete a core curriculum including: a seminar in singing health specialization, laryngology lecture series, laryngology surgical observation, clinical observation (at the Ohio State Voice Clinic), and a pedagogy lab practicum, during which students are directly observed while working with singers who have vocal injuries. All pedagogy students learn to use instrumentation via voice laboratory assignments. The Ohio State University Voice Teaching and Research Laboratory Suite is equipped with instrumentation for acoustic and aerodynamic analysis, EGG and endoscopy/stroboscopy. As a matter of necessity, Ohio State University has the structural foundation of a school of medicine, music and communication sciences to support such an interdisciplinary program. The faculty includes experts from the school of music (Dr. Peeler and Dr. McCoy), school of medicine/department of otolaryngology (Dr. Forrest), department of speech and hearing science (Dr. Trudeau), and the voice and

swallowing disorders clinic (Ms. Obert). In the future, Ohio State University hopes to continue to grow the program and eventually to offer a stand-alone certificate. Currently, students must be enrolled at Ohio State University to pursue the Singing Health Specialization training (Scott McCoy, personal contact, January 30, 2012). For more information, see [https://sphs.osu.edu/files/sphs/singing\\_health\\_specialist\\_maslp.pdf](https://sphs.osu.edu/files/sphs/singing_health_specialist_maslp.pdf).

The University of Iowa offers an add-on vocology track for specialty voice training in the speech-language pathology MA and PhD programs in the Department of Communication Sciences and Disorders. These courses are also open to students within the DMA in Performance/Pedagogy programs in the School of Music. This 9-credit graduate program is given during a summer semester hosted at the University of Utah through the Summer Vocology Institute via the National Center for Voice and Speech in Salt Lake City, Utah. It is open to anyone, but attendees are usually laryngologists, speech-pathologists, and vocal pedagogues. Courses include Principles of Voice Production, Instrumentation for Voice Analysis, Voice Habilitation, and Voice for Performers. See [www.uiowa.edu](http://www.uiowa.edu) and [http://www.ncvs.org/svi\\_infous.html](http://www.ncvs.org/svi_infous.html) for more information.

The Shenandoah Conservatory offers a DMA in vocal pedagogy program that includes education in voice science (function and anatomy), vocal health/medical applications, instrumentation, vocal pedagogy and clinical observation. Sataloff et al. write “To acquire the necessary knowledge to become a singing voice specialist, it is helpful for the interested singing teacher to take advantage of available graduate courses in speech science, neuroanatomy, neurophysiology, and speech-language pathology...In addition, even for experienced voice teachers, a professional internship of some sort is

almost imperative” (Sataloff et al 2006, p. 273). To that end, students in the Shenandoah Conservatory DMA program take classes such as Anatomy and Function of the Singing Voice, Voice Disorders, and Supervised Studio Teaching. Throughout these courses, students use textbooks by Scott McCoy, DMA, Robert Sataloff, MD, DMA, Joseph Stemple, PhD, Don Miller, PhD and others. The in-class coursework is supplemented by an internship in a noted voice clinic involving otolaryngologists, speech therapists, voice teachers, and/or voice scientists. This program is one of the only pedagogy programs in the country to include a full course in voice disorders and clinical observation. It is an excellent choice for singing voice vocologists who want to work as a singing health specialist. A special consideration is the training in classical as well as contemporary commercial music obtained by the students in this program, therefore increasing the range of expertise for their future work with injured singers of varying genres and styles. (<http://www.su.edu/conservatory/431F3F1238394F69AF06B90B9973C0A0.asp>, accessed January 3, 2011; Kathryn Green, personal communication, February 15, 2012).

The Master of Music degree in vocal pedagogy at Westminster Choir College offers an excellent curriculum that delves deeper into the areas of voice science than almost any other voice pedagogy program in the country. Courses focus on voice pedagogy methods, the function and anatomy of the singing voice, and practical application of pedagogical techniques to teaching repertoire. Students are supervised by master teachers and observe others teaching (both group and private lessons) during their teaching internship. Students learn to use voice instrumentation and better understand or research the human voice in the Westminster Voice Laboratory, with technology including CSL and Multi-speech platforms (Kay-Pentax), VoceVista, electroglottography

(vocal fold movement measures), and respirometry (pulmonary measures). Coursework does not include specialized classes in voice disorders or medical applications. In short, this program is an excellent training opportunity for voice pedagogy students, but it does not deliver the health component necessary for those vocologists who want to work with injured singers. For further information, see: <http://www.rider.edu/wcc/graduate-programs/voice-pedagogy-and-performance>.

*Private training programs.* Karen Wicklund, MHS, CCC-SLP, DM offers a non-degree Singing Voice Specialist Training program in three levels out of the Chicago Center for Professional Voice. Wicklund is an associate professor of voice at Western Michigan University and Clinic Supervisor at the Van Riper Clinic where she is a speech-language pathologist. Wicklund states that singing voice specialists are specially-trained and educated voice teachers, not speech-language pathologists. Her singing voice specialist program is a 56 clock-hour program that includes coursework, practicum and continuing education. She uses her own textbook, *Singing Voice Rehabilitation: A guide for the voice teacher and speech-language pathologist* (Wicklund, 2010). The textbook offers a concise overview of vocal anatomy and physiology, vocal injuries and their effect of vocal parameters, vocal outcome tracks for singers, the voice care team, singing voice therapy protocol, therapeutic song repertoire for classical and musical theater singers, and prevention of vocal injury. For more information see [http://www.wmich.edu/music/faculty/faculty\\_pages/som\\_fac\\_wicklundkaren.htm](http://www.wmich.edu/music/faculty/faculty_pages/som_fac_wicklundkaren.htm) (accessed February 15, 2012).

Saint John's University, located in Collegeville, Minnesota, hosts the Bodymind and Voice Course through the VoiceCare Network. The VoiceCare Network is "a non-profit corporation...It is aided by an 11-member professional Board of Advisors who represent the areas of Voice and Voice Science, Voice Medicine, Child Voices, Adolescent Voices, Music Education, Choral Conducting, and the Neuropsychobiology of Learning. We resolve to create an expanding network of people who want to: teach healthy and expressive voice skills, continue to learn effective teaching methods, and improve their own voices" ([www.voicecarenetwork.org](http://www.voicecarenetwork.org), accessed February 12, 2012). The VoiceCare Network is affiliated with the National Center for Voice and Speech and is endorsed by the National Association of Teachers of Singing, among others. To become a member of the VoiceCare Network, a student must take the BodyMind and Voice Course, which is based on the Bodymind and Voice: Foundations of Voice Education textbook (<http://www.voicecarenetwork.org/courseinfo.cfm?ID=4>). The course includes movement efficiency group sessions based on Alexander Technique, learning Methods and Laban Movement Analysis. Topics include personal voice and voice health, conducting gestures and voice, teaching and learning, child voice, male/female changing voice, older adult voice. Once the course is completed, students are eligible to take further continuing courses. The upcoming course will occur from July 5-12, 2012. See [www.voicecarenetwork.org](http://www.voicecarenetwork.org) for more information.

The New York Singing Teachers Association offers a professional development program consisting of a series of live courses and online webinars taught by leading experts in the field and designed for practicing professionals. It is possible to gain graduate credit for the courses through Westminster Choir College. Each course

concludes with an exam, and those who pass all five courses and corresponding exams receive NYSTA's Distinguished Voice Professional Certificate of Completion. The current five core course offerings are: Vocal Anatomy & Physiology (Dr. Scott McCoy), Voice Acoustics & Resonance (Dr. Scott McCoy), Vocal Health for Voice Professionals, Singer's Developmental Repertoire, and Comparative Voice Pedagogy. The courses are worth 1 credit each, and cost only \$150 per credit. For more information, see [www.nyst.org/pdplandingpage.html](http://www.nyst.org/pdplandingpage.html) (accessed February 12, 2012).

*Clinical experience.* Singing voice vocologists should seek out training in a clinical medical setting to gain experience to supplement knowledge gained from classes and books/articles. This clinical training can occur through a university or private program (see above), through a graduate internship/clinical fellowship, or through a private arrangement with a practicing professional. All speech-language pathologists are required to complete supervised graduate clinical internship placements (semester-long) and a partially supervised, mentored clinical fellowship (36 weeks) prior to gaining their certificate of clinical competence from ASHA. Those speech-pathologists planning to work with singers would benefit from obtaining a graduate clinical internship placement and clinical fellowship in a voice or voice and swallowing center during graduate school. If this is not possible, the student should seek out a mentor and observe as much as possible at a voice center during graduate school. It is important to note that there are few clinical fellowships established in voice and swallowing centers. As a result, the interview process is competitive, and graduate clinical experience with voice is helpful in the process (see Table 6).

Table 6: Clinical training opportunities at voice centers for speech-language pathologists

Center	Training	Location	Website
Blaine Block Institute for Voice Analysis and Rehabilitation	Graduate internship only	Dayton, OH	<a href="http://www.bbivar.com/internship.php">http://www.bbivar.com/internship.php</a>
Cleveland Clinic: The Voice Center at the Head and Neck Institute	Clinical Fellowship	Cleveland, OH	<a href="http://my.clevelandclinic.org/head_neck/about/default.aspx">http://my.clevelandclinic.org/head_neck/about/default.aspx</a>
Emory Voice Center	Clinical Fellowship	Atlanta, GA	<a href="http://otolaryngology.emory.edu/ed_and_train/fellowship/speech-lang-path.html">http://otolaryngology.emory.edu/ed_and_train/fellowship/speech-lang-path.html</a>
NW Clinic for Voice & Swallowing at the Oregon health & Science University	Clinical Fellowship	Portland, OR	<a href="http://www.ohsu.edu/xd/health/services/ent/services/nw-clinic-for-voice-and-swallowing/index.cfm">http://www.ohsu.edu/xd/health/services/ent/services/nw-clinic-for-voice-and-swallowing/index.cfm</a>
University of Kentucky Clinical Voice Center	Clinical Fellowship	Lexington, KY	<a href="http://ukhealthcare.uky.edu/voice/">http://ukhealthcare.uky.edu/voice/</a>
University of Pittsburgh Voice Center	Clinical Fellowship	Pittsburgh, PA	<a href="http://www.upmc.com/Services/Otolaryngology/ServicesandSpecialties/VoiceCenter/Pages/FellowshipOpportunities.aspx">http://www.upmc.com/Services/Otolaryngology/ServicesandSpecialties/VoiceCenter/Pages/FellowshipOpportunities.aspx</a>
University of Wisconsin Hospital Madison: Voice and Swallowing Clinic, Professional and Performing Voice Programs	Clinical Fellowship	Madison, WI	<a href="http://www.uwhealth.org/voice-swallow/voice-and-swallowing/11279">http://www.uwhealth.org/voice-swallow/voice-and-swallowing/11279</a>
Vanderbilt Voice Center	Clinical Fellowship	Nashville, TN	<a href="http://www.vanderbilthealth.com/billwilkinson/26740">http://www.vanderbilthealth.com/billwilkinson/26740</a>

Non-speech pathologists would benefit from establishing a relationship with a speech-pathologist or otolaryngologist and arranging an unofficial observation of the clinical practice of working with singers at a voice center. (See Table 5 in Chapter 3). Alternatively, non-speech pathologists may obtain clinical experience through some of the university and private training programs listed above.

*Professional organizations.* Professional organizations can be very helpful for the education of vocologists, as they host conferences, publish peer-reviewed journals of current research in the field, offer educational courses, and provide many other functions. Some of the leading organizations for vocologists are the Voice Foundation, the National Association of Teachers of Singing (NATS), American Speech-language Hearing Association (ASHA), and the New York Singing Teachers Association (NYSTA). Other organizations, like Voice And Speech Teachers Association and the Acoustical Society of America, are excellent sources of information and networking for vocologists, but will not be described below.

The Voice Foundation is the oldest existing organization dedicated to voice medicine, science, and education. The Voice Foundation was founded in 1969 by voice specialist Wilber James Gould, MD. At that time, interdisciplinary voice care did not exist. Dr. Gould sought to bring together physicians, scientists, speech-language pathologists, performers, and voice teachers to exchange knowledge and ideas regarding professional voice care. In 1989, Dr. Robert Thayer Sataloff, MD, DMA, FACS, a laryngologist, professional singer and prolific author, became chairman of the Voice Foundation. The mission of the Voice Foundation is to enhance knowledge, care and training of the voice through educational programs and publications for voice care professionals, the public and professional voice users, and through supporting and funding research. Among other things, the Voice Foundation publishes the *Journal of Voice*, the world's premiere peer-reviewed journal for voice medicine and research, and

hosts an annual symposium. Membership is open to all at varying levels of financial dues. See [www.voicefoundation.org](http://www.voicefoundation.org) for more information.

Founded in 1944, National Association of Teachers of Singing, Inc. (NATS) is the largest professional association of teachers of singing in the world with more than 7,000 members in the United States, Canada, and over twenty-five other countries. NATS offers a variety of lifelong learning experiences to its members: workshops, intern programs, master classes, and conferences. Students of NATS members have access to one of the organization's most widely recognized activities: Student Auditions. They have the opportunity, along with members, to compete at a national level through National Association of Teachers of Singing Artist Awards (NATSAA). In 2012, NATS will begin auditioning for the first National Musical Theater Competition (NMTC). Final Rounds for NATSAA and NMTC will take place at the NATS 52nd National Conference in Orlando. NATS supports the growth and enrichment of its members through the publication of *Journal of Singing*, a scholarly journal comprised of articles, written by distinguished experts, on all aspects of singing and the teaching of singing ([www.nats.org](http://www.nats.org), accessed January 14, 2012).

The mission statement of NATS is “to encourage the highest standards of the vocal art and of ethical principles in the teaching of singing; and to promote vocal education and research at all levels, both for the enrichment of the general public and for the professional advancement of the talented” ([www.nats.org](http://www.nats.org), accessed January 14, 2012).

To become a full member of NATS, a person must be at least 25 years old who has known personal integrity, accepts and abides by the Code of Ethics, teaches an average of six or more voice students each week, and have a degree in singing or equivalent teaching experience. Associate membership is granted to those who do not yet qualify for full membership, and affiliate membership is open to individuals in related fields, institutions, and businesses.

The American Speech-Language Hearing Association (ASHA) is the professional, scientific and credentialing association for 145,000 members and affiliates who are speech-language pathologists, audiologists, and speech, language, and hearing scientists

in the United States and internationally. The mission statement of ASHA is empowering and supporting speech-language pathologists, audiologists, and speech, language, and hearing scientists by: advocating on behalf of persons with communication and related disorders, advancing communication science, and promoting effective human communication. ASHA began in 1925 with 25 members. ASHA publishes four journals. ASHA also offers special interest groups in 18 areas. The 3<sup>rd</sup> Special Interest Group is Voice and Voice Disorders. Benefits of membership include access to the online publication, Perspectives on Voice and Voice Disorders, continuing education opportunities and networking. The goals of the organization are to create a higher profile for the area of voice within ASHA and allied fields, to serve as a liaison with other organizations, like NATS and the Voice Foundation, and to broaden educational opportunities, among other things. For more information see: <http://www.asha.org/SIG/03/About-SIG-3/> and [www.asha.org](http://www.asha.org)

The New York Singing Teachers' Association (NYSTA) is the oldest professional association of singing teachers and voice professionals. It was founded in 1906 and is centered in New York with local, national and international members. NYSTA prides itself on educating people who work with the singing voice across all musical genres. NYSTA offers online education through professional development courses. It is possible to locate a voice teacher through the NYSTA find a teacher link on the website. Membership to NYSTA is available to voice teachers, vocal coaches, choir directors, singers, music and stage directors, otolaryngologists, speech pathologists, and others who have an interest in the singing voice. Membership is available in four levels: active singing teachers who have taught for at least five years, apprentice teachers with less than

five years of professional teaching experience, associate members from professionals who support singers, and student members who are under 25 years of age. See [www.nysta.org](http://www.nysta.org) for more information.

*Recommended reading.* It is also recommended for vocologists to read textbooks and articles from the peer-reviewed journals. Suggested textbooks for broad-based information include:

Boone, D. R., McFarlane, S. C., Von Berg, S. L., & Zraick, R. I. (2010). *The voice and voice therapy, 8<sup>th</sup> Edition*. Boston, MA: Allyn & Bacon.

Benninger, M, Jacobson, B., & Johnson, A. (1993). *Vocal arts medicine: The care and prevention of professional voice disorders*. New York: Thieme Medical Publishers.

Benninger, M. & Murry, T. (2006). *The performer's voice*. San Diego, CA: Plural Publishing.

Coffin, B. (2002). *Sounds of singing: Principles and applications of vocal techniques with chromatic vowel chart*. Lanham, MD: Scarecrow Press.

Colton, R. H., Casper, J. K., & Leonard, R. (2006). *Understanding voice problems: a physiological perspective for diagnosis and treatment*. Baltimore, MD: Lippincott Williams & Wilkins.

Gallena, S. (2007). *Voice and laryngeal disorders*. St. Louis, MO: Mosby Elsevier.

Hiranu, M. & Bless, D. (1993). *Stroboscopic Examination of the Larynx*. San Diego, CA: Plural Publishing.

Kendall, K. & Leonard, R., Eds. (2010). *Laryngeal evaluation: Indirect laryngoscopy to high-speed digital imaging*. New York: Thieme Medical Publishers.

LoVetri, J. (In preparation). *Contemporary Commercial Music Vocal Pedagogy: Somatic Voicework the LoVetri Method*.

Ma, E. P. & Yiu, E. M. (2011). *Handbook of Voice Assessments*. San Diego, CA: Plural Publishing.

- McCoy, S. (2004). *Your voice: An inside view*. Princeton, NJ: Inside View Press.
- Melton, Joan. (2007). *Singing in Musical Theatre: The Training of Singers and Actors*. New York: Allworth Press.
- Miller, R. (1986). *The structure of singing: System and art in vocal technique*. New York: Schirmer Books.
- Netter, F. H. (2006). *Atlas of the human body*. Hauppauge, NY: Icon Learning Systems.
- Sapienza, C., & Hoffman-Ruddy, B. (2009). *Voice disorders*. San Diego, CA: Plural Publishing.
- Sataloff, R.T. (2005). *Clinical assessment of voice*. San Diego, CA: Plural Publishing.
- \_\_\_\_\_. (2005). *Professional voice: The science and art of clinical care, 3rd Edition*. San Diego, CA: Plural Publishing, Inc.
- \_\_\_\_\_. (2005). *Treatment of voice disorders*. San Diego, CA: Plural Publishing.
- \_\_\_\_\_. (2006). *Vocal health and pedagogy, Second Edition*. San Diego, CA: Plural Publishing, Inc.
- Schwartz, S. (2004). *The source for voice disorders: Adolescent and adult*. East Moline, IL: LinguiSystems.
- Stemple, S., Glaze, L., & Gereman, B. (2010). *Clinical voice pathology: Theory and Management, 4<sup>th</sup> Edition*. San Diego, CA: Singular Publishing Group.
- Sundberg, J. (1987). *The science of the singing voice*. DeKalb, IL: Northern Illinois University Press.
- Titze, I. R. (2000). *Principles of voice production*. Iowa City, IA: The National Center for Voice and Speech.
- Titze, I. R. & Verdolini, K. (In preparation). *Vocology*.
- Wicklund, K. (2009). *Singing Voice Rehabilitation: A guide for the Voice Teacher and Speech-Language Pathologist*. DelMar-Cengage Publishing.

Journals of interest to the vocologist include:

*Journal of the American Speech-Language-Hearing Association*

*Journal of Voice*

*Journal of Singing*

*Journal of Logopedics Phoniatrics & Vocology*

*Laryngoscope*

*Conferences.* To enhance one's education in singing voice vocology, many conferences are available on an annual and bi-annual basis. Access to a calendar of conferences is available through the NCVS website [ncvs.org](http://ncvs.org) and facebook page <http://www.facebook.com/pages/NCVS-Voice-Conference-Calendar/276205292401307>. The most well-known and largest national conferences are the Voice Foundation Annual Symposium, the bi-annual National Association of Teachers of Singing National Conference, and the annual American Speech-Language Hearing Association Annual Convention. Smaller conferences include the Fall Voice Conference (held in various locations) and the Advanced Practices in Voice and Dysphagia conference in Las Vegas. International conferences include: the International Conferences on Voice Physiology and Biomechanics (ICVPB – 8<sup>th</sup> annual July 2012) ([www.icvpb2012.de](http://www.icvpb2012.de)); International Association of Logopedics and Phoniatrics (IALP) – held every three years [www.ialp.info](http://www.ialp.info); the Pan-European Voice Conference (PEVOC) –held biennially [www.pevoc.org](http://www.pevoc.org); the International Conference on the Physiology and Acoustics of Singing (PAS) held biennially. The World Voice Congress will hold its 5<sup>th</sup> International Congress of World Voice Consortium in Luxor, Egypt in October 2012. The first International Voice Symposium was held at NYU in January 2012. Some of these conferences are described in further detail below.

The Voice Foundation Annual Symposium: Care of the Professional Voice is held every year in June in Philadelphia. 2012 will mark the 41<sup>st</sup> annual symposium. The goal of the symposium is to bring together top vocal health professionals to share the latest advances in scientific and medical voice research. An entire session is devoted to workshops for practical application of scientific principles. Publishers and other companies related to voice offer products throughout the symposium. Attendees include researchers in voice, laryngologists, speech pathologists, teachers of singing, acting and speaking, and performing artists. The symposium is an interdisciplinary event uniting medicine, art and science. See [www.voicefoundation.org](http://www.voicefoundation.org) for more information.

The National Association of Teachers of Singing National Conference is now held on a bi-annual schedule (even years) in a different city each year. July 2012 marks the 52<sup>nd</sup> National Conference. The conference offers lectures, workshops and concerts in the areas of vocal repertoire, pedagogy, science, styles, performance, and other areas. See <http://nationalconference.nats.org/general-information/> for more information.

The American Speech-Language-Hearing Association (ASHA) Convention is held on an annual basis in various cities throughout the United States. The convention caters to more than 12,000 attendees. There is, however, a smaller segment of the convention that is devoted to voice. Here, speech pathologists and other interested attendees can opt to hear sessions on new voice research and panel discussions on topics of special interest to voice therapists. See <http://www.asha.org/events/convention/> for more information.

April 16 was initiated as World Voice Day in Brazil in 1999, and has become an internationally recognized event. On World Voice Day, the goal is to increase public

awareness of the voice and voice problems. Although it is not an official conference, it is a day of “celebration of interaction between arts and science” (Svec, 2007).

*Vocal training across genres.* A singing voice vocologist should have a working knowledge of his or her voice. This can be obtained through accredited university programs in voice or the equivalent experience obtained through a combination of voice lessons and performing experience. Bachelor and Master of Music programs provide instruction in technique, performance, repertoire, style, pedagogy, diction and music theory/history. Professionals who work with injured singers should seek training across many genres of singing. As long as a singer can produce a sound healthfully, that sound can be used in singing. Specialists working to rehabilitate the singing voice should be prepared to work with singers from almost all backgrounds, and should have training in pedagogy of classical and contemporary commercial music singing. Due to the many differences between classical and contemporary commercial music (CCM) singing, a person must seek serious training in both areas. Unfortunately, comprehensive training and teacher-training (pedagogy skills) are much more difficult to obtain in CCM singing genres than in classical singing.

Classical and CCM singers differ fundamentally in three significant ways: technique/style, training, and vocal/performance demands. Classical singing refers to the European singing tradition stemming from the high-art styles (i.e. Opera, art song, choral church music) funded by the courts and churches of Europe over the centuries (LoVetri, 2008, p. 260). CCM, on the other hand, is “the new term for what we call non-classical music. This is a generic term created to cover everything including music theater, pop,

rock, gospel, R&B, soul, hip hop, rap, country, folk, experimental music, and all other styles that are not considered classical” (LoVetri, 2008, p. 260). LoVetri explains that classical and CCM singing comparison does not make sense, since “classical singing may not be useful as a viable measure of the vocal production in CCM styles” (LoVetri, 2008, p. 261). Yet, it is helpful in this instance to draw distinctions between the technique, training and performance demands of classical and CCM singers to show the fundamental differences between the two styles and the different concerns and needs of the two distinct populations of singers.

The technique for CCM singing differs in many ways from that of classical singing. Classical production is generally CT dominant with a balanced *chiaroscuro* (bright and dark) quality, uses consistent vibrato, uses formal articulation patterns, blends registers (to avoid breaks), avoids noise, breathiness and nasality in favor of a clear, even tone, and is intended to be self-amplified by the singer’s formant cluster in the 2,500-3,500 Hz range. CCM production, on the other hand, is usually chest voice dominant, is extremely bright in timbre, is created with little or no vibrato, often has clear register breaks, and is based on speech/colloquial articulation (American Academy of Teachers of Singing papers, 2008). CCM styles usually incorporate a wide dynamic range (soft to loud) and a broad range of vocal qualities, including breathiness, harsh/pressed production, smokiness, straight-tone, noise, nasality and other qualities that may be considered out of the typical acceptable technique in classical singing. According to Schutte and Miller, CCM texts are more dominant than the music compared to classical texts and require more precise articulation to resemble speech (resulting in less opportunity for vowel modification), naturalness of sound is of high importance, the

singer has a high place vis-à-vis the composition, and improvisation is usually more accepted as a standard part of the style (Schutte & Miller, 1993).

Perhaps the most significant differences between classical and CCM techniques of singing are the use of amplification and speech-based singing, e.g. “belt” voice and twang. “All CCM styles evolved from colloquial speech, and all of them are electronically amplified. Therefore, CCM vocal production cannot be divorced from amplification” (LoVetri, 2008, p. 261). The inclusion of electronic amplification in vocal production of CCM music changes the technical needs and the desired output from the singer significantly. It opens the possibility for the production of many sounds that would be too nuanced, quiet or otherwise inappropriate for use in traditional classical unamplified singing. These speech-based sounds span a wide spectrum, from a breathy whisper to a full-voiced belt, though very little research has been done on CCM techniques outside of Broadway belting. The Broadway belt voice is described in general as TA dominant, having a greater closed phase, having a high larynx position, and tuning F1 to H2 (Schutte & Miller, 1993, p. 149; Miller, 2008, p. 88). For belting, the mouth shape is usually very wide and the tension is increased in the jaw area. Furthermore, the TA dominant sound is limited to the low and middle registers, so CCM repertoire is usually in a more contained range than classical repertoire (with the exception of Mariah Carey and similar voices). Pop singing that is non-belting usually uses less pressure, but continues to use the high larynx position. All of these factors contribute to higher possibility of phonotrauma in CCM singing than in the standard classical technique (Harm et al., 1993). For more information regarding research on belting and pop vs.

classical singing techniques and acoustic findings, see Harm et al. (1993) and Lebowitz (2011) (these contain an excellent summary and bibliography regarding this topic).

The training for CCM singing is markedly different from that of classical singing. Foremost, classical singers are trained within a long tradition of teachers. Many college and graduate programs are designed to train classical singers. CCM, on the other hand, has few organized training programs and higher-level education options. Even though there are now more programs for musical theater, “most of the voice teachers available to teach these students are classically trained” (Hall, 2007). “Research shows that the vast majority (approximately 85%) of those who are teaching CCM musical theater have no professional training or experience to do so” (LoVetri, 2008, p. 262). Weekly & LoVetri (2009) found that 74% of the teachers that they surveyed taught CCM (66% taught music theater specifically). 90% of teachers also taught classical technique to their CCM students. Yet, only 7% of the musical theater voice teachers surveyed had both training and professional experience in musical theater. Furthermore, almost half of those surveyed had neither training nor professional experience in the realm of musical theater.

Overall, “the training of singing teachers does not yet appear to have adjusted to the growing demand for teachers with expertise in both classical and music theater styles” (Weekly & LoVetri, 2009, p. 373). Very few teachers taught CCM styles outside of musical theater and no teachers taught experimental styles. Few teachers were able to describe scientific terms regarding processes vital to creating healthy CCM sounds. Thus, CCM students have few options for learning CCM styles from experienced and well-trained teachers. For this reason, many CCM students do not continue to take lessons, or they take lessons and then do what they need to sing in their desired style

without instruction. “Those CCM singers who have chosen to take singing lessons have been, and still are, on their own in trying to figure out how to make practical use of what they are taught, as the vast majority of training is still strictly classically based” (LoVetri 2008, p. 261). Overall, CCM students often take many fewer years of CCM lessons than classical singers take of classical lessons. This leaves CCM students at a greater risk for vocal problems and with fewer mentors to monitor their progress and help them to know when to seek help for vocal problems. It also puts students in of CCM styles at a higher risk for having “coachings” for repertoire rather than lessons in which real technique is taught.

Finally, vocal performance demands are often quite different for CCM and classical singers. CCM singers often need to demonstrate simultaneous acting, singing, and dancing. CCM singers also often need to perform sets of 3-4 hours of solo performances. Both classical and CCM singers need to balance a “day job” and a singing career, but the CCM singers are often performing at night, without appropriate breaks, without union-enforced breaks and performance time limits, in smoky atmospheres, while drinking alcohol, and in noisy places (i.e. bars, nightclubs) with mediocre or subpar amplification systems distorting the self-feedback loop. These factors all lead to higher possibility for vocal injury for CCM singers than for classical singers.

Of note: According to Phyland et al. (1999), “Singing style did not prove to have a significant influence on singers’ experiences of vocal impairment, disability or handicap. Although all singer groups reported high prevalence of voice problems, there were no significant differences between the opera, musical theater, and “contemporary – other than rock- singer groups. [However the study had] relative homogeneity of singer

subjects in terms of singing training, experience and other variables of potential influence on the incidence and prevalence of voice problems among singers” (p. 610).

In sum, the differences between CCM and classical singing are significant in terms of technique, training and vocal performance/lifestyle demands. The disparity is enough to warrant distinct programs for training the two styles. Currently, there are very few training programs for CCM singers. Even in programs that do teach CCM specifically, singers usually are required to take 1-2 years of classical voice lessons. In a recent conversation with Karen Hall, PhD (November 23, 2011), she emphasized the importance of a paradigm shift in the treatment of CCM singing. CCM techniques can be taught on their own, with solid technique that is not necessarily classical in foundation (however, there would be many similarities in the training). Robert Edwin put it well, “our naïve colleagues who say, “Singing is singing. If you have a solid classical technique, you can sing anything,” are inviting vocal disaster if they impose classical vocal technique and sounds on the [contemporary] style of singing” (Edwin, 1998, p. 61).

Most professional singers in this country are paid to sing popular music, especially young performers. They need the opportunity to receive training appropriate to their needs, especially considering that the CCM population is already at a higher risk for injury. It is very important that these programs become developed at the university level for three reasons. First, CCM singers need to develop music skills in a well-rounded way. Second, students need consistent study with well-trained instructors who have experience in the field. Third, teachers need to be trained in the style, theory, technique and history of the field in order to adequately train the next generation.

Currently, degrees in Music Theater and CCM performance are available throughout the country. Examples of schools that offer voice lessons from well-trained instructors within the department of Music Theater, Jazz or CCM include, but are not limited to the schools listed in Table 7.

While many schools offer CCM training, only three academic institutions in this country currently offer master's degrees in pedagogy for CCM voice: Shenandoah Conservatory (CCM), Penn State University (Musical Theatre), and New York University (Musical Theatre). These programs are in their infancy. There are presently no doctoral degrees in CCM voice pedagogy. (The Shenandoah DMA would be the closest, in that all pedagogy students are required to take Jeanette LoVetri's CCM workshops.) As more programs become available, the availability of well-trained teachers will increase and, consequently, the training opportunities for vocologists in CCM singing.

In the Shenandoah Conservatory vocal pedagogy program, it is possible to obtain a master's degree in vocal pedagogy with an emphasis in either classical or CCM voice. In the CCM track, students are required to take courses including: anatomy and function of the voice, technology in the studio, CCM vocal pedagogy levels 1-3, CCM vocal pedagogy styles and comparative vocal teaching methods (<http://www.su.edu/conservatory/9AF52BDC5BAC4FA7B9D229F45D826CE6.asp>, accessed January 5, 2012).

Table 7. University and Collegiate Programs in CCM Singing

School	Location	Degree	Pedagogy	Website
NYU Steinhardt	New York, New York	Master of Music in Vocal Performance with a specialization in Music Theatre	Advanced Certificate in Vocal pedagogy possibility (Combined 48 credits)	<a href="http://steinhardt.nyu.edu/music/theatre/programs/graduate">http://steinhardt.nyu.edu/music/theatre/programs/graduate</a>
NYU Steinhardt	New York, New York	Doctor of Philosophy in Vocal Performance with a Concentration in Jazz; Master of Music in Performance with a concentration in Jazz; Bachelor of Music with sequence in Jazz	No	<a href="http://steinhardt.nyu.edu/music/jazz">http://steinhardt.nyu.edu/music/jazz</a>
Penn State School of Theatre	State College, PA	Bachelor of Fine Arts in Musical Theatre	Voice Pedagogy for Musical Theatre	<a href="http://theatre.psu.edu/programs">http://theatre.psu.edu/programs</a>
Carnegie Mellon School of Music	Pittsburgh, PA	Bachelor of Fine Arts in Vocal Performance (Music Theatre or Classical)	No	<a href="http://www.music.cmu.edu/programs.php?sub_page=undergraduate&amp;third_page_programs=null&amp;fourth_page_programs=null&amp;fifth_page_programs=null">http://www.music.cmu.edu/programs.php?sub_page=undergraduate&amp;third_page_programs=null&amp;fourth_page_programs=null&amp;fifth_page_programs=null</a>
College-Conservatory of Music (University of Cincinnati)	Cincinnati, OH	Bachelor of Fine Arts in Musical Theatre	No	<a href="http://ccm.uc.edu/theatre/musical_theatre/overview/curriculum.html">http://ccm.uc.edu/theatre/musical_theatre/overview/curriculum.html</a>
Belmont University	Nashville, TN	Bachelor and Master of Music in Commercial Music (Performance)	Only classical voice ped.	<a href="http://www.belmont.edu/music/degrees/music_graduate/mm_commercial_music/index.html">http://www.belmont.edu/music/degrees/music_graduate/mm_commercial_music/index.html</a>
Berklee College of Music	Boston, MA/ Valencia Spain	Master of Music in Contemporary Studio Performance	No	<a href="http://berkleevalencia.org/academic-programs/master-degrees/master-of-music-in-contemporary-studio-performance/">http://berkleevalencia.org/academic-programs/master-degrees/master-of-music-in-contemporary-studio-performance/</a>

Table 7. (continued)

Berklee College of Music	Boston, MA	Bachelor of Music in Professional Performance: Voice (All contemporary music styles including jazz, pop, rock, and theater)	No	<a href="http://www.berklee.edu/departments/voice.html">http://www.berklee.edu/departments/voice.html</a>
University of Michigan School of Music, Theatre & Dance	Ann Arbor, MI	Bachelor of Fine Arts in Musical Theatre	No	<a href="http://www.music.umich.edu/departments/mustheatre/index.php">http://www.music.umich.edu/departments/mustheatre/index.php</a>
Boston Conservatory	Boston, MA	Bachelor of Fine Arts and Master of Music in Musical Theater	No	<a href="http://www.bostonconservatory.edu/theater">http://www.bostonconservatory.edu/theater</a>
University of Miami	Miami, FL	Bachelor of Fine Arts in Musical Theatre	No	<a href="http://www.as.miami.edu/theatrearts/programs.html">http://www.as.miami.edu/theatrearts/programs.html</a>
American Musical and Dramatic Academy	New York, NY and Los Angeles, CA	Bachelor of Fine Arts in Musical Theatre and The Integrated Program (Acting, Dance and Musical Theatre) Two-year conservatory program	No	<a href="http://www.amda.edu/programs/musical-theatre/">http://www.amda.edu/programs/musical-theatre/</a>
Shenandoah Conservatory	Winchester, VA	Bachelor of Fine Arts in Musical Theatre; Bachelor, Master and Doctorate of Music in Voice Performance (with the option of specializing in CCM)	Yes – including CCM styles at the Master’s and Doctoral levels	<a href="http://www.su.edu/conservatory/6374542347894543BD3A42FB3CCE74BD.asp">http://www.su.edu/conservatory/6374542347894543BD3A42FB3CCE74BD.asp</a>
USC Thornton School of Music	Los Angeles, CA	Bachelor of Music in Popular Music	No	<a href="http://www.usc.edu/schools/music/programs/popular_music/">http://www.usc.edu/schools/music/programs/popular_music/</a>
Musicians Institute College of Contemporary Music	Los Angeles, CA	Bachelor of Music in Contemporary Music (Vocals)	No	<a href="http://www.mi.edu/">http://www.mi.edu/</a> <a href="http://www.mi.edu/vocals#bachelor-of-music">http://www.mi.edu/vocals#bachelor-of-music</a>

Penn State University began its Master of Fine Arts in Theatre, Voice Pedagogy for Musical Theater in the Fall 2011 semester. The course is still being officially organized and currently has one student with the expectation of accepting two students

every two years. Qualified applicants should be mature teachers with significant performing and teaching experience. The program is interdisciplinary between the schools of music and theatre and is subject to the accreditation standards of both the Association of Schools of Theatre and the National Association of Schools of Music. It is a 60-credit hour, 6-semester program with at least 20% in advanced analytical theatre studies. The program “provides students the opportunity to study in depth the vocal techniques specific to musical theatre performance and the performance practices that define the art form. The classical pedagogy program already in place in the School of Music will provide a significant part of the basic curriculum in order to ensure a comprehensive working knowledge of the vocal instrument. A graduate of this course of study should feel equally at home teaching classical and musical theatre repertoire, respecting the important distinctions between them” (Saunders, 2012). Students are required to participate in the School of Theatre’s Summer in London Program (including an international studio intensive) and an internship with a prominent musical theatre voice professional in a location of their choosing. Students must also write a monograph including a teaching portfolio. Students teach musical theater voice students under the direct supervision of master musical teacher Mary Saunders-Barton and classical teacher Gordon Spivey. See [http://theatre.psu.edu/programs/mfa\\_voice](http://theatre.psu.edu/programs/mfa_voice) for more information.

New York University Steinhardt School of Culture, Education, and Human Development offers a Master of Music in Voice combined with an Advanced Certificate in Vocal Pedagogy through the Department of Music and Performing Arts professions. Students may be classical or musical theater majors to complete this degree. A minimum of 18 credits is required for the completion of an Advanced Certificate in Vocal

Pedagogy. All students in the program must have already earned a masters degree in music. Core courses for the certificate include two vocal pedagogy courses, private voice lessons, and classical and music theatre vocal repertoire for teaching. Students may opt from among the following electives for the remaining five credits: Therapeutic Approach in Speech Pathology: Voice Disorders; Voice Disorders; Speech Science: Instrumentation; Music Theatre Workshop (Song Analysis); Opera Workshop (Song Analysis); and Private Voice Instruction. The first three elective courses listed above are offered through the communication sciences and communication disorders department. Therefore, it is possible for students to receive an education with advanced knowledge in medical applications of voice rehabilitation. For more information, see <http://steinhardt.nyu.edu/music/theatre/programs/advcertificate>.

Some non-university training courses for learning to sing and teach musical theater styles include Somatic Voicework, the Estill Method, and Bel Canto/Can Belto. These short workshops work best in combination with voice lessons from expert teachers in CCM styles.

Jeanette (Jeanie) LoVetri's holds a CCM program in a three-level course called Somatic Voicework, the LoVetri Method. The level I program is offered at the University of Massachusetts Dartmouth in the Department of Jazz and at the University of Michigan at the medical center in the department of Speech Language Pathology (the only vocal pedagogy program to be offered in a university hospital setting). The foundation of the program is helping every singer to access his or her true voice, and consequently a large range of sounds produced healthfully and truthfully. For more information see: [www.thevoiceworkshop.com/index.html](http://www.thevoiceworkshop.com/index.html).

Jo Estill created a system called ‘compulsory figures’ which is designed to help a singer to feel and control each distinct part of the vocal mechanism. She uses the term “postural anchoring” for *appoggio* and describes six vocal qualities: speech, falsetto, cry, twang, opera, and belt. The program is based on the use of imagery to describe vocal sounds, like “sob” and “laugh.” Courses are offered worldwide and can be accessed via <http://www.estillvoice.com/>.

Bel Canto/ Can Belto, created and taught by Mary Saunders-Barton, is a program designed to teach a hybrid classical and musical theater technique based on speech. Mary believes that speech IS singing and vice-versa (Mary Saunders-Barton, personal communication, March 3, 2012). The program addresses function rather than style and focuses on speaking and acting during singing. A healthy production and understanding of one’s chest, belt, and head voice is the desired result. The four-day workshop takes place in State College every other year (odd years). DVD’s are available for \$60. See [www.belcantocanbelto.com](http://www.belcantocanbelto.com) for more information.

## CHAPTER 5: FUTURE DIRECTIONS

Given the information compiled in this review, there are clear areas that require further attention and development from the vocologist community. Future directions will be outlined below for instrumentation in the voice studio, medical applications and training opportunities for singing voice vocologists.

Regarding technology, the most pressing order of business is to create an evidence base regarding the efficacy of instrumentation in the voice studio. In order for this to occur, both singing voice specialists, speech pathologists and voice teachers will need to conduct research studies that explore the use of biofeedback in the voice therapy room and in the singing voice studio. Possible studies could be the use of acoustic analysis in the voice studio and therapy room, the use of video and audio recording in the therapy room (Emory), the use of virtual reality in treatment (Emory), and the use of slow-motion video playback in voice therapy and singing lessons. In order for this to occur, therapists and teachers must become more involved in research and become comfortable and knowledgeable with instrumentation. Several high-level vocal pedagogues and voice therapists (Scott McCoy, Jeannette LoVetri, Christian Herbst) believe that instrumentation is best for informing the teacher, but should not to be used as a staple in the teaching studio. More studies would confirm or challenge these ideas and add to our ability to work within evidence-based practice.

As advances in high-speed endoscopy continue, it would be beneficial to apply that technology to the singing voice (Rita Patel, personal communication, July 8, 2012). Furthermore, it would be an excellent advancement to coordinate a video recording

simultaneously with acoustic analysis, a planned feature for the next version of VoceVista (Donald Miller, personal communication, April 16, 2012).

In terms of the medical model, the most important issue for singing voice vocologists is to determine the official role and title of the singing voice specialist/singing health specialist/ clinical singing voice rehabilitation specialist and create the appropriate curriculum to establish the training requirements/guidelines of this role. The process has been ongoing for approximately 30 years, and the creation of several training programs in the last decade is a sign of forward progress. Standardization of a curriculum/requirements and accreditation by ASHA and NATS will ultimately solve this problem and allow for real progress in this area.

In general, the field seems to be moving slowly towards the model of preventive medicine. In this model, singers establish a connection with a voice team when they are healthy to obtain baseline measurements and hygiene check-ups/instruction at well visits. Although most singers only seek the aid of a voice team when they are in a state of pathology, programs such as Wendy LeBorgne's at Cincinnati Conservatory of Music will help to educate singers about the importance of prevention and having a voice care team established prior to injury. Innovative programs, such as the musical theatre program at Penn State University, strive towards this model as a gold standard and hope to attain a relationship with a voice center in the near future (Mary Saunders-Barton, personal communication, March 3, 2012). The next generation of vocologists can help this process by drawing connections between schools of music and voice centers to increase awareness of and access to voice services. Furthermore, as mentioned above, more studies supporting the efficacy of complementary and alternative medications and

techniques for voice treatment would help to keep singers healthy from a holistic perspective, including mind, body and spirit.

Training for vocologists is improving every year. In this developing field, vocologists must take responsibility for upholding the integrity of the field by instituting training programs that fulfill the main requirements of singing health specialists: knowledge of vocal anatomy, physiology and voice disorders, knowledge of singing pedagogy, technique and style (including both classical and CCM genres), clinical experience in a medical setting treating injured singers and vocal performance experience at a professional level. While new programs exist that address some of these aspects of vology, there is still no formal, accredited, recognized curriculum and “Knowledge and Skills Acquired” for the vocologist. Also, there are very few places where a person can receive training in CCM pedagogy, let alone study commercial music singing with a qualified and effective teacher. It is imperative that all of these areas are improved to meet the training needs of vocologists.

Overall, the information collected in this document will be disseminated to the vology community via the internet in order to create an awareness of the state of vology and to encourage greater interaction and attention to the issues brought to light via this research.

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APPENDIX A: GLOSSARY OF ACRONYMS

Table 8. Glossary of Acronyms

<b>Acronym</b>	<b>Expansion of acronym</b>
<b>ASHA</b>	American Speech-Language Hearing Association
<b>CCC</b>	Certificate of Clinical Competence
<b>CCM</b>	Contemporary Commercial Music
<b>CFY</b>	Clinical Fellowship Year
<b>CIM</b>	Complementary and Integrative Medicine
<b>CSL</b>	Computerized Speech Laboratory
<b>DMA</b>	Doctor of Musical Arts
<b>EGG</b>	Electroglottography
<b>ENT</b>	Ear, nose, throat
<b>GERD</b>	Gastroesophageal Reflux Disease
<b>MTD</b>	Muscle Tension Dysphonia
<b>NATS</b>	National Association of Teachers of Singing
<b>NCVS</b>	National Center for Voice and Speech
<b>NYSTA</b>	New York Singing Teachers' Association
<b>PAS</b>	Phonatory Aerodynamic System
<b>SLP</b>	Speech-Language Pathologist
<b>SVS</b>	Singing Voice Specialist
<b>VCD</b>	Vocal Cord Dysfunction

## APPENDIX B: SINGING VOICE SPECIALIST SURVEY TOPICS

Table 9. Singing Voice Specialist Survey Topics

<b>Category</b>	<b>Question</b>
<b>Assessment procedures</b>	What is the assessment protocol for your voice center?
<b>Assessment instrumentation</b>	What type of instrumentation does your center use to acquire baseline data during voice assessments?
<b>Singing voice therapy vs. lessons</b>	In your opinion, what are the differences between voice therapy (voice rehabilitation) and voice lessons (voice habilitation)?
<b>Therapy instrumentation</b>	What type of instrumentation do you use during therapy sessions?
	How do you use instrumentation to track progress?
	Do you use any instrumentation for biofeedback during therapy sessions?