

Professional Voice

The Science and Art of Clinical Care

Fourth Edition

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Glossary

This glossary has been developed from the author's experience and also from a review of glossaries developed by Johan Sundberg (personal communication, June 1995), Ingo Titze (*Principles of Voice Production*, Englewood, NJ: Prentice Hall, 1994:330–338), and other sources. It is difficult to credit appropriately contributions to glossaries or dictionaries of general terms, as each new glossary builds on prior works. The author is indebted to colleagues whose previous efforts have contributed to the compilation of this glossary.

AAO-HNS: American Academy of Otolaryngology-Head and Neck Surgery

abduct: To move apart, separate

abduction quotient: The ratio of the glottal half-width at the vocal processes to the amplitude of vibration of the vocal fold

abscess: Collection of pus

absolute jitter (Jita): A discrete measure of very short-term (cycle-to-cycle) variation of the pitch periods expressed in microseconds. This parameter is dependent on the fundamental frequency of the voicing sample. Therefore, normative data differ significantly for men and women. Higher pitch results in lower Jita

absolute voice rest: Total silence of the phonatory system

acceleration: The rate of change of velocity with respect to time (measured in millimeters per square second, mm/s²)

acoustic power: The physical measure of the amount of energy produced and radiated into the air per second (measured in watts)

acoustical zero decibels: 0.0002 microbar

actin: A protein molecule that reacts with myosin to form actinomyosin, the contractile part of a myofibril in muscle

acting-voice trainer: (1) *See also Voice Coach*; (2) A professional with specialized training who may work with injured voices as part of a medical voice team in an effort to optimize speaking voice performance

Adam's apple: Prominence of the thyroid cartilage, primarily in males

adduct: To bring together, approximate

affricate: Combination of plosive and fricative consonants such as /dʒ/

AIDS: Acquired Immune Deficiency Syndrome

allergy: Bodily response to foreign substances or organisms

alto: (*See Contralto*)

alveolar ridge: The bony ridge of the gum into which the teeth insert

AMA: American Medical Association

amplitude: Maximum excursion of an undulating signal from the equilibrium; the amplitude of a sound wave is related to the perceived loudness; mostly it is expressed as a logarithmic, comparative level measure using the decibel (dB) unit

amplitude perturbation quotient (APQ): A relative evaluation of short-term (cycle-to-cycle) variation of peak-to-peak amplitude expressed in percent. This measure uses a smoothing factor of 11 periods

amplitude spectrum: A display of relative amplitude vs frequency of the sinusoidal components of a waveform

amplitude-to-length ratio: The ratio of vibrational amplitude at the center of the vocal fold to the length of the vocal fold

amplitude tremor: Regular (periodic) long-term amplitude variation (an element of vibrato)

amplitude tremor frequency (Fatr): This measure is expressed in Hz and shows the frequency of the most intensive low-frequency amplitude-modulating component in the specified amplitude-tremor analysis range

amplitude tremor intensity index (ATRI): The average ratio of the amplitude of the most intensive low-frequency amplitude modulating component (amplitude tremor) to the total amplitude of the analyzed sample. The algorithm for tremor analysis determines the strongest periodic amplitude modulation of the voice. This measure is expressed in percent

anabolic steroids: Primarily male hormones, increase muscle mass and may cause irreversible, masculinization of the voice. Anabolic steroids help cells convert simple substances into more complex substances, especially into living matter

anisotropic: Property of a material that produces different strains when identical stresses are applied in different directions

antagonist (muscle): An opposing muscle

anterior: Toward the front

anterior commissure: The junction of the vocal folds in the front of the larynx

antibiotic: Drug used to combat infection (bodily invasion by a living organism such as a bacteria or virus). Most antibiotics have action specifically against bacteria

anticoagulant: Blood thinner; agent that impairs blood clotting

antihistamine: Drug to combat allergic response

antinodes: The "peaks" in a standing wave pattern

aperiodic: Irregular behavior that has no definite period; is usually either chaotic or ran

attractor: A geometric figure in state space to which all trajectories in its vicinity are drawn. The 4 types of attractors are (1) *point*, (2) *limit cycle*, (3) *toroidal*, and (4) *strange*. A point trajectory draws all trajectories to a single point. An example is a pendulum moving toward rest. A limit cycle is characteristic of periodic motion. A toroidal attractor represents quasiperiodic motion (often considered a subset of periodic motion). A strange attractor is associated with chaotic motion

back vowel: A vowel produced by pulling the tongue posteriorly, with relation to its neutral position

bands: Range of adjacent parameter values; a frequency band is an ensemble of adjacent frequencies

bandpass filter: Filter that allows frequencies only within a certain frequency range to pass

baritone: The most common male vocal range. Higher than bass and lower than tenor. Singer's formant around 2600 Hz

basement membrane: Anatomic structure immediately beneath the epithelium

bass: (*See Basso*)

bass baritone: In between bass and baritone. Not as heavy as *basso profundo*, but typically with greater flexibility. Must be able to sing at least as high as F_4 . Also known as *basso cantante* and *basso guisto*. Baritones with bass quality are also called *basse taille*

basso: Lowest male voice. Singer's formant around 2300 to 2400 Hz

basso profundo: Deep bass. The lowest and heaviest of the bass voices. Can sing at least as low as D_2 with full voice. Singer's formant around 2200 to 2300 Hz. Also known as *contra-basso*

bel canto: Literally means "beautiful singing." Refers to a method and philosophical approach to singing voice production

benchmark: The standard by which other similar occurrences are judged

benign tumors: Tumors that are not able to metastasize or spread to distant sites

Bernoulli's principle: If the energy in a confined fluid stream is constant, an increase in particle velocity must be accompanied by a decrease in pressure against the wall

bifurcation: A sudden qualitative change in the behavior of a system. In chaos, for example, a small

change in the initial parameters of a stable (predominantly linear) system may cause oscillation between 2 different states as the nonlinear aspects of the system become manifest. This transition is a bifurcation

bilabial covering: Using the lips to constrict the mouth opening and "cover" the sound. This technique is used commonly by young singers in the form of slight vowel distortion to attenuate upper harmonics and make a sound richer and less brash.

bilateral: On both sides

bilateral vocal fold paralysis: Loss of the ability to move both vocal folds caused by neurologic dysfunction

biomechanics: The study of the mechanics of biological tissue

bleat: Fast vibrato, like the bleating of a sheep

body: With regard to the vocal fold, the vocalis muscle

Boyle's law: In a soft-walled enclosure and at a constant temperature, pressure and volume are inversely related

bravura: Brilliant, elaborate, showy execution of musical or dramatic material

break: (*See Passagio*)

breathy phonation: Phonation characterized by a lack of vocal fold closure; this causes air leakage (excessive airflow) during the quasi-closed phase, and this produces turbulence that is heard as noise mixed in the voice

bronchitis: Inflammation of the bronchial tubes in the lungs

bronchospasm: Forceful closing of the distal airways in the lungs

bruxism: Grinding of the teeth

bulimia: Self-induced vomiting to control weight

butterfly effect: Refers to the notion that in chaotic (nonlinear dynamics) systems a minuscule change in initial condition may have profound effects on the behavior of the system. For example, a butterfly flapping its wings in Hong Kong may change the weather in New York

cancer: An abnormality in which cells no longer respond to the signals that control replication and growth. This results in uncontrolled growth and tumor formation, and may result in spread of tumor to distant locations (metastasis)

carrier: (1) In physics, a waveform (typically a sinusoid) whose frequency or amplitude is modulated by a signal. (2) In medicine, a person who is colonized by an organism (typically bacteria such as streptococcus or pneumococcus), but who has no symptoms or adverse effects from the presence of the organism. Nevertheless, that carrier is able to transmit the organism to other people in whom it does cause a symptomatic infection

cartilage: One of the tissues of the skeleton; it is more flexible than bone

cartilage of Santorini: Small cartilage flexibly attached near the apex of the arytenoid, in the region of the opening of the esophagus

cartilage of Wrisberg: Cartilage attached in the mobile portion of each aryepiglottic fold

castrato: Male singer castrated at around age 7 or 8, so as to retain alto or soprano vocal range

category: Voice type classified according to pitch range and voice quality; the most frequently used categories are bass, baritone, tenor, alto, mezzosoprano, and soprano, but many other subdivisions of these exist

caudal: Toward the tail

central vowel: A vowel produced with the tongue at or near neutral position

chaos: A qualitative description of a dynamic system that seems unpredictable, but actually has a "hidden" order. Also a mathematical field that studies fractal geometry and nonlinear dynamics

chaotic behavior: Distinct from random or periodic behavior. A chaotic system *looks* disorganized or random but is actually deterministic, although aperiodic. It has sensitive dependence on initial condition, has definite form, and is bounded to a relatively narrow range (unable to go off into infinity)

chest voice: Heavy registration with excessive resonance in the lower formants

coarticulation: A condition in which one phoneme influences the production of phonemes before and after it, resulting commonly in degradation of the quality and clarity of the surrounding sounds

cochlea: Inner ear organ of hearing

coefficient of amplitude variation (vAm): This measure, expressed in percent, computes the relative standard deviation of the peak-to-peak amplitude. It increases regardless of the type of amplitude variation

coefficient of fundamental frequency variation (vF₀): This measure, expressed in percent, computes the relative standard deviation of the fundamental frequency. It is the ratio of the standard deviation of the period-to-period variation to the average fundamental frequency

collagen: The protein substance of the white (collagenous) fibers of cartilage, bone, tendon, skin, and all of the connective tissues. Collagen may be extracted, processed, and injected into the vocal fold to treat various abnormalities

collagenase: An enzyme that catalyzes the degradation of collagen

coloratura: In common usage, refers to the highest of the female voices, with range well above C₆. May use more whistle tone than other female voices. In fact, coloratura actually refers to a style of florid, agile, complex singing that may apply to any voice classification. For example, the bass runs in Händel's *Messiah* require coloratura technique

complex periodic vibration: A sound that repeats regularly. A pattern of simultaneously sounding partials

complex sound: A combination of sinusoidal waveforms superimposed upon each other. May be complex periodic sound (such as musical instruments) or complex aperiodic sound (such as random street noise)

complex tone: Tone composed of a series of simultaneously sounding partials

component frequency: Mathematically, a sinusoid; perceptually, a pure tone. Also called a *partial*

compression: A deformation of a body that decreases its entire volume. An increase in density

concert pitch: Also known as *international concert pitch*. The standard of tuning A₄. Reference pitch has changed substantially over the last 200 to 300 years

condensation: An increase in density

constructive interference: The interference of 2 or more waves such that enhancement occurs

contact ulcer: A lesion with mucosal disruption most commonly on the vocal processes or medial surfaces of the arytenoids. Caused most commonly by gastroesophageal reflux laryngitis and/or muscular tension dysphonia

contrabasso: (*See Basso profundo*)

contraction: A decrease in length

contralto: Lowest of the female voices. Able to sing F_3 below middle C, as well as the entire treble staff. Singer's formant at around 2800 to 2900 Hz

conus elasticus: Fibroelastic membrane extending inferiorly from the vocal folds to the anterior superior border of the cricoid cartilage. Also called the *cricovocal ligament*. Composed primarily of yellow elastic tissue. Anteriorly, it attaches to the minor aspect of the thyroid cartilage. Posteriorly, it attaches to the vocal process of the arytenoids

convergent: With regard to glottal shape, the glottis narrows from bottom to top

corner vowels: (a), (i), and (u); vowels at the corners of a vowel triangle; they necessitate extreme placements of the tongue

corticosteroid: Potent substances produced by the adrenal cortex (excluding sex hormones of adrenal origin) in response to the release of adrenocorticotrophic hormone from the pituitary gland, or related substances. Glucocorticoids influence carbohydrate, fat, and protein metabolism. Mineralocorticoids help regular electrolyte and water balance. Some corticosteroids have both effects to varying degrees. Corticosteroids may also be given as medications for various effects, including anti-inflammatory, antineoplastic, immune suppressive, and ACTH secretion suppressive effects, as well as for hormone replacement therapy

countertenor: Male voice that is primarily falsetto, singing in the contralto range. Most countertenors are also able to sing in the baritone or tenor range. Countertenors are also known as *contraltino* or *contratenor*

cover: (1) In medicine, with regard to the vocal fold, the epithelium and superficial layer of lamina propria. (2) In music, an alteration in technique that changes the resonance characteristics of a sung sound, generally darkening the sound

cranial nerves: Twelve paired nerves responsible for smell, taste, eye movement, vision, facial sensation, chewing muscles, facial motion, salivary gland and lacrimal (tear) gland secretions, hearing, balance, pharyngeal and laryngeal sensation, vocal fold motion, gastric acid secretion, shoulder motion, tongue motion, and related functions

creaky voice: The perceptual result of subharmonic or chaotic patterns in the glottal waveform. According to Ingo R Titze, if a subharmonic is below about 70 Hz, creaky voice may be perceived as pulse register (vocal fry)

crescendo: To get gradually louder

cricoid cartilage: A solid ring of cartilage located below and behind the thyroid cartilage

cricothyroid muscle: An intrinsic laryngeal muscle that is used primarily to control pitch (paired)

crossover frequency: The fundamental frequency for which there is an equal probability for perception of 2 adjacent registers

cycle: One complete set of regularly recurring events

cysts: Fluid-filled lesions

damp: To diminish, or attenuate an oscillation

damped oscillation: Oscillation in which energy is lost during each cycle until oscillation stops

decibel: One-tenth of a bel. The decibel is a unit of comparison between a reference and another point. It has no absolute value. Although decibels are used to measure sound, they are also used (with different references) to measure heat, light, and other physical phenomena. For sound pressure, the reference is 0.0002 microbar (millionths of 1 barometric pressure). In the past, this has also been referred to as 0.0002 dyne/cm², and by other terms

decrescendo: (*See Diminuendo*)

deformation: The result of stress applied to any surface of a deformable continuous medium. Elongation, compression, contraction, and shear are examples

dehydration: Fluid deprivation. This may alter the amount and viscosity of vocal fold lubrication and the properties of the vocal fold tissues themselves

destructive interference: The interference of 2 or more waves such that full or partial cancellation occurs

dialect: A variety of a spoken language, usually associated with a distinct geographical, social, or political environment

diaphragm: A large, dome-shaped muscle at the bottom of the rib cage that separates the lungs from the viscera. It is the primary muscle of inspiration and may be co-activated during singing

diminuendo: To get gradually softer

diphthong: Two consecutive vowels occurring in the same syllable

displacement: The distance between 2 points in space, including the direction from one point to the other

displacement flow: Air in the glottis that is squeezed out when the vocal folds come together

diuretic: A drug to decrease circulating body fluid generally by excretion through the kidneys

divergent: With regard to the vocal folds, the glottis widens from bottom to top

dizziness: A feeling of imbalance

dorsal: Toward the back

down-regulation: Decreased gene expression, compared with baseline

dramatic soprano: Soprano with powerful, rich voice suitable for dramatic, heavily orchestrated, operatic roles. Sings at least to C₆

dramatic tenor: Tenor with heavy voice, often with a suggestion of baritone quality. Suitable for dramatic roles that are heavily orchestrated. Also referred to as *tenora robusto* and *helden tenor*. The term *helden tenor* (literally "heroic" tenor) is used typically for tenors who sing Wagnerian operatic roles

dynamics: (1) In physics, a branch of mechanics that deals with the study of forces that accelerate object(s). (2) In music, it refers to changes in the loudness of musical performance

dysmenorrhea: Painful menstrual cramps

dyspepsia: Epigastric discomfort, especially following meals; impairment of the power or function of digestion

dysphonia: Abnormal voicing

dysphonia plica ventricularis: Phonation using false vocal fold vibration rather than true vocal fold vibration. Most commonly associated with severe muscular tension dysphonia. Occasionally may be an appropriate compensation for profound true vocal fold dysfunction

dystonia: A neurological disorder characterized by involuntary movements, such as unpredictable, spasmodic opening or closing of the vocal folds

edema: Excessive accumulation of fluid in tissues, or "swelling"

elastic recoil pressure: The alveolar pressure derived from extended (strained) tissue in the lungs, rib cage, and the entire thorax after inspiration (measured in Pascals)

electroglottograph (EGG): Recording of electrical conductance of vocal fold contact area vs time; EGG waveforms have been frequently used for the purpose of plotting voice source analysis

electromyograph (EMG): Recording of the electric potentials in a muscle, which are generated by the neural system and which control its degree of con-

traction; if rectified and smoothed the EMG is closely related to the muscular force exerted by the muscle

elongation: An increase in length

embouchure: The shape of the lips, tongue, and related structures adopted while producing a musical tone, particularly while playing a wind instrument

endocrine: Relating to hormones and the organs that produce them

endometriosis: A disorder in which endometrial tissue is present in abnormal locations. Typically causes excessively painful menstrual periods (dysmenorrhea) and infertility

epiglottis: Cartilage that covers over the larynx during swallowing

epilarynx: A region bordered by the rim of the epiglottis and the glottis synonymous with epiglottal tube. This resonating region is considered by some to be the site of origin of the singer's formant

epithelium: The covering, or most superficial layer, of body surfaces

erythema: Redness

esophagus: Tube leading from the bottom of the pharynx to the stomach; swallowed food is transported through this structure

expansion: A deformation of a body such that the entire volume increases

extrinsic muscles of the larynx: The strap muscles in the neck, responsible for adjusting laryngeal height and for stabilizing the larynx

Fach (German): Literally, job specialty. It is used to indicate voice classification. For example, lyric soprano and dramatic soprano are different Faches

false vocal folds: Folds of tissue located slightly higher than and parallel to the vocal folds in the larynx

falsetto: High, light register, applied primarily to men's voices singing in the soprano or alto range. Can also be applied to women's voices

fibroblasts: Cells responsible in part for the formation of scar in response to tissue injury

fibrosis: Generally refers to a component of scar caused by cross-linking of fibers during a reactive or a reparative process

flat singing: Usually refers to pitch (frequency) lower than the desirable target frequency. Sometimes also used to refer to a singing style devoid of excitement or emotional expression

flow: The volume of fluid passing through a given cross section of a tube or duct per second; also called volume velocity (measured in liters per second)

flow glottogram: Recording of the transglottal air-flow versus time, ie, of the sound of the voice source. Generally obtained from inverse filtering, FLOGG is the acoustical representation of the voice source

flow phonation: The optimal balance between vocal fold adductory forces and subglottic pressure, producing efficient sound production at the level of the vocal folds

flow resistance: The ratio of pressure to flow

fluid: A substance that is either a liquid or a gas

fluid mechanics: The study of motion or deformation of liquids and gases

flutter: Modulation in the 10 to 12 Hz range

F₀: Fundamental frequency

F₀-tremor frequency (F_{ft}): This measure is expressed in Hz and shows the frequency of the most intensive low-frequency F₀modulating component in the specified F₀ tremor analysis range

F₀-tremor intensity index (FTRI): The average ratio of the frequency magnitude of the most intensive low-frequency modulating component (F₀ tremor) to the total frequency magnitude of the analyzed sample. The algorithm for tremor analysis determines the strongest periodic frequency modulation of the voice. This measure is expressed in percent

focal: Limited to a specific area. For example, spasmodic dysphonia may be focal (limited to the larynx), or part of a group of dystonias that affect other parts of the body such as the facial muscles or muscles involved in chewing

force: A push or pull; the physical quantity imparted to an object to change its momentum

forced oscillation: Oscillation imposed on a system by an external source

formant: Vocal tract resonance; the formant frequencies are tuned by the vocal tract shape and determine much of the vocal quality

formant tuning: A boosting of vocal intensity when F₀ or one of its harmonics coincides exactly with a formant frequency

front vowel: A vowel formed by displacing the tongue anteriorly, with regard to its neutral position

fractal: A geometric figure in which an identical pattern or motif repeats itself over and over on an

ever-diminishing scale. Self-similarity is an essential characteristic

fractal dimension: Fractal dimensions are measures of fractal objects that can be used to determine how alike or different the objects are. Box counting algorithms and mass-radius measurement are 2 common approaches to determining fractal dimension. The fractal dimension represents the way a set of points fills a given area of space. It may be defined as the slope of the function relating the number of points contained in a given radius (or its magnification) to the radius itself. For example, an object can be assessed under many magnifications. The coast of Britain can be measured, for example, with a meter stick or a millimeter stick, but the latter will yield a larger measure. As magnification is increased (smaller measuring sticks), a point will be reached at which small changes in magnification no longer significantly affect length. That is, a plot of coastline length vs magnification reaches a plateau. That plateau corresponds to fractal dimension. The more irregular the figure (eg, coastline), the more complex and the more space it occupies, hence, the higher its fractal dimension. A perfect line has a fractal dimension of 1. A figure that fills a plane has a fractal dimension of 2. Fractal dimension cannot be used alone to determine the presence or absence of chaotic behavior

frequency analysis: Same as spectrum analysis

frequency tremor: A periodic (regular) pitch modulation of the voice (an element of vibrato)

fricative: A speech sound, generally a consonant, produced by a constriction of the vocal tract, particularly by directing the airstream against a hard surface, producing noisy air turbulence. Examples include *s* produced with the teeth, *s* produced with the lower lip and upper incisors, and *th* produced with the tongue tip and upper incisors

frontal (or coronal) plane: An anatomic plane that divides the body into anterior and posterior portions; across the crown of the head

functional residual capacity (FRC): Lung volume at which the elastic inspiratory forces equal the elastic expiratory forces; in spontaneous quiet breathing exhalation stops at FRC

functional voice disorder: An abnormality in voice sound and function in the absence of an anatomic or physiologic organic abnormality

fundamental: Lowest partial of a spectrum, the frequency of which normally corresponds to the pitch perceived

fundamental frequency (F_0): The lowest frequency in a periodic waveform; also called the first harmonic frequency

gas: A substance that preserves neither shape nor volume when acted upon by forces, but adapts readily to the size and shape of its container

gastric: Pertaining to the stomach

gastric juice: The contents of the stomach, ordinarily including a high concentration of hydrochloric acid.

gastroesophageal reflux (GER): The passage of gastric juice in a retrograde fashion from the stomach into the esophagus. These fluids may reach the level of the larynx or oral cavity, and may be aspirated into the lungs

gastroesophageal reflux disease (GERD): A disorder including symptoms and/or signs caused by reflux of gastric juice into the esophagus and elsewhere. Heartburn is one of the most common symptoms of GERD. (*See also* **Laryngopharyngeal reflux**)

genomics: The study of genes (genetic material) made up of DNA, and located in the chromosomes of the nuclei of cells in an organism

glide: A written consonant that is produced as a vowel sound in transition to the following vowel. Examples include /j/ and /w/

glissando: A “slide” including all possible pitches between the initial and final pitch sounded. Similar to portamento and slur

globus: Sensation of a lump in the throat

glottal: At the level of the vocal folds

glottal chink: Opening in the glottis during vocal fold adduction, most commonly posteriorly. It may be a normal variant in some cases

glottal resistance: Ratio between transglottal airflow and subglottal pressure; mainly reflects the degree of glottal adduction

glottal stop (or click): A transient sound caused by the sudden onset or offset of phonation

glottal stroke: A brief event in which air pressure is increased behind the occluded glottis and then released, more gently than following a glottal stop. Glottal strokes are used to separate phonemes in linguistic situations in which running them together might result in misunderstanding of the meaning

glottis: Space between the vocal folds. (*See also* **Rima glottidis**)

glottis respiratoria: The portion of the glottis posteriorly in the region of the cartilaginous portions of the vocal folds

glottis vocalis: The portion of the glottis in the region of the membranous portions of the vocal folds

grace days: Refers to a former contractual arrangement, especially in European Opera Houses, in which women were permitted to refrain from singing during the premenstrual and early menstrual portions of their cycles, at their discretion

granuloma: A raised lesion generally covered with mucosa, most commonly in the region of the vocal process or medial surface of the arytenoid. Often caused by reflux and/or muscle tension dysphonia

halitosis: Bad breath

harmonic: A frequency that is an integer multiple of a given fundamental. Harmonics of a fundamental are equally spaced in frequency. Partial in a spectrum in which the frequency of each partial equals n times the fundamental frequency, n being the number of the harmonic

harsh glottal attack: Initiating phonation of a word or sound with a glottal plosive

head voice: A vocal quality characterized by flexibility and lightness of tone. In some classifications, it is used to designate a high register of the singing voice

hemorrhage: Rupture of a blood vessel. This may occur in a vocal fold

hertz: Cycles per second (Hz) (named after Gustav Hertz)

high pass filter: Filter that only allows frequencies above a certain cutoff frequency to pass; the cutoff is generally not abrupt but, rather, gentle and is given in terms of a roll-off value (eg, 24 dB/octave)

histogram: Graph showing the occurrence of a parameter value; thus, a fundamental frequency histogram shows the occurrence of different fundamental frequency values (eg, in fluent speech or in a song)

Hooke's law: Stress in proportion to strain; or, in simpler form, force is proportional to elongation

hormones: Substances produced within the body that affect or control various organs and bodily functions

hyoid bone: A horseshoe-shaped bone known as the “tongue bone.” It is attached to muscles of the tongue and related structures, and to the larynx and related structures

hyperfunction: Excessive muscle effort for example, pressed voice, muscle tension dysphonia

hypernasal: Excessive nasal resonance

hypofunction: Low muscular effort, for example, soft breathy voice

hyponasal: Deficient nasal resonance

hypothyroidism: Lower than normal output of thyroid hormone. This condition is referred to commonly as an “underactive thyroid,” and often results in malaise, weight gain, temperature intolerance, irregular menses, muffling of the voice, and other symptoms

Hz: (*See Hertz*)

impotence: The inability to accomplish penile erection

in vitro: Outside the living body, for example, an excised larynx

in vivo: In the living body

incompressibility: Property of a substance that conserves volume in a deformation

inertia: Sluggishness; a property of resisting a change in momentum

inferior: Below

infertility: The inability to accomplish pregnancy

infraglottic: Below the level of the glottis (space between the vocal folds). This region includes the trachea, thorax, and related structures

infraglottic vocal tract: Below the level of the vocal folds. This region includes the airways and muscles of support (infraglottic is synonymous with subglottic)

infrahyoid muscle group: A collection of extrinsic muscles including the sternohyoid, sternothyroid, omohyoid, and thyroid muscles

insertion: The point of attachment of a muscle with a bone that can be moved by the muscle

intensity: A measure of power per unit area. With respect to sound, it generally correlates with perceived loudness

interarytenoid muscle: An intrinsic laryngeal muscle that connects the 2 arytenoid cartilages

intercostal muscles: Muscles between the ribs

interval: The difference between 2 pitches, expressed in terms of musical scale

intrinsic laryngeal muscles: muscles within the larynx responsible for abduction, adduction, and longitudinal tension of the vocal folds

intrinsic pitch of vowels: Refers to the fact that in normal speech certain vowels tend to be produced with a significantly higher or lower pitch than other vowels

inverse filtering: Method used for recovering the transglottal airflow during phonation; the technique implies that the voice is fed through a computer filter that compensates for the resonance effects of the supraglottic vocal tract, especially the lowest formants

inverse square law: Sound intensity is inversely proportional to the square of the distance from the sound source

IPA: International Phonetic Alphabet (*See Appendix I*)

isometric: Constant muscle length during contraction

iteration: In mathematics, the repetitive process of substituting the solution to an equation back into the same equation to obtain the next solution

jitter: Irregularity in the period of time of vocal fold vibrations; cycle-to-cycle variation in fundamental frequency; jitter is often perceived as hoarseness

jitter percent (Jitt): A relative measure of very short term (cycle-to-cycle) variation of the pitch periods expressed in percent. The influence of the average fundamental frequency is significantly reduced. This parameter is very sensitive to pitch variations

juvenile papillomatosis: A disease of children characterized by the clustering of many papillomas (small blisterlike growths) over the vocal folds and elsewhere in the larynx and trachea. Papillomatosis may also occur in adults, in which case the adjective *juvenile* is not used. The disease is caused by human papillomavirus

keratosis: A buildup of keratin (a tough, fibrous protein) on the surface of the vocal folds

kinematics: The study of movement as a consequence of known or assumed forces

kinetic energy: The energy of matter in motion (measured in joules)

klangfarbe: Tone color, referring to vocal quality

labiodental: A consonant produced by bringing the lower lip in contact with the upper front teeth

lag: A difference in time between one point and another

lamina propria: With reference to the larynx, the tissue layers below the epithelium. In adult humans,

the lamina propria consists of superficial, intermediate, and deep layers

laminar: Smooth or layered; in fluid mechanics, indicating parallel flow lines

laminar flow: Airflow in smooth layers over a surface (as differentiated from irregular, or turbulent flow)

laryngeal sacculle: (See **Appendix of the Ventricle of Morgagni**)

laryngeal sinus: (See **Ventricle of Morgagni**)

laryngeal ventricle: Cavity formed by the gap between the true and false vocal folds

laryngeal web: An abnormal tissue connection attaching the vocal folds to each other

laryngectomy: Removal of the larynx. It may be total, or it may be a “conservation laryngectomy,” in which a portion of the larynx is preserved

laryngitis: Inflammation of laryngeal tissues

laryngitis sicca: Dry voice

laryngocele: A pouch or herniation of the larynx, usually filled with air and sometimes presenting as a neck mass. The pouch usually enlarges with increased laryngeal pressure as may occur from coughing or playing a wind instrument

laryngologist: Physician specializing in disorders of the larynx and voice, in most countries. In some areas of Europe, the laryngologist is primarily responsible for surgery, while diagnosis is performed by phoniatricians

laryngomalacia: A condition in which the laryngeal cartilages are excessively soft and may collapse in response to inspiratory pressures, obstructing the airway

laryngopharyngeal reflux (LPR): A form of gastroesophageal reflux disease in which gastric juice affects the larynx and adjacent structures. Commonly associated with hoarseness, frequent throat clearing, granulomas, and other laryngeal problems, even in the absence of heartburn

laryngospasm: Sudden, forceful, and abnormal closing of the vocal folds

larynx: The body organ in the neck that includes the vocal folds. The “voice box”

larynx height: Vertical position of the larynx; mostly measured in relation to the rest position

larynx tube: Cavity formed by the vocal folds and the arytenoid, epiglottis, and thyroid cartilages and the structures joining them

laser: An acronym for *light amplification by stimulated emission of radiation*. A surgical tool using light energy to vaporize or cauterize tissue

lateral: Toward the side (away from the center).

lateral cricoarytenoid muscle: Intrinsic laryngeal muscle that adducts the vocal folds through forward rocking and rotation of the arytenoids (paired)

LD₅₀: In determining drug toxicity, the LD₅₀ is the amount of the substance that will cause death in 50% of test specimens (lethal dose for 50%)

legato: Smooth, connected

lesion: In medicine, a nonspecific term that may be used for nearly any structural abnormality

leukoplakia: A white plaque. Typically, this occurs on mucous membranes, including the vocal folds

level: Logarithmic and comparative measure of sound intensity; the unit is normally dB

lied: Song, particularly art song

lift: (See **Passaggio**)

ligament: Connective tissue between articular regions of bone

linear system: A system in which the relation between input and output varies in a constant, or linear, fashion

linguadental: A consonant produced by bringing the tongue in contact with the teeth

lingual: Related to the tongue

linguapalatal: A consonant produced by bringing the tongue in contact with the hard palate

lip covering: Altering lip shape to make a sound less brash or bright, and “rounder” or more “rich”

liquid: A substance that assumes the shape of its container, but preserves its volume

loft: A suggested term for the highest (loftiest) register; usually referred to as *falsetto voice*

logistic map: A simple quadratic equation that exhibits chaotic behavior under special initial conditions and parameters. It is the simplest chaotic system

Lombard effect: Modification of vocal loudness in response to auditory input. For example, the ten-

endency to speak louder in the presence of background noise

long-term average spectrum (LTAS): Graph showing a long-time average of the sound intensity in various frequency bands; the appearance of an LTAS is strongly dependent on the filters used

longitudinal: Along the length of a structure

longitudinal tension: With reference to the larynx, stretching the vocal folds

loudness: The amount of sound perceived by a listener; a perceptual quantity that can only be assessed with an auditory system. Loudness corresponds to intensity, and to the amplitude of a sound wave

low pass filter: Filter that allows only frequencies below a certain frequency to pass; the cutoff is generally not at all abrupt but gentle and is given in terms of a roll-off value (eg, 24 dB/octave)

LTAS: An acronym for long-term-averaged spectrum

lung volume: Volume contained in the subglottic air system; after a maximum inhalation following a maximum exhalation the lung volume equals the vital capacity

lyric soprano: Soprano with flexible, light vocal quality, but one who does not sing as high as a coloratura soprano

lyric tenor: Tenor with a light, high flexible voice

malignant tumor: Tumors that have the potential to metastasize, or spread to different sites. They also have the potential to invade, destroy, and replace adjacent tissues. However, benign tumors may have the capacity for substantial local destruction, as well

Mandelbrot's set: A series of 2 equations containing real and imaginary components that, when iterated and plotted on a 2-dimensional graph, depict a very complex and classic fractal pattern

mandible: Jaw

marcato: Each note accented

marking: Using the voice gently (typically during rehearsals) to avoid injury or fatigue

masque (mask): "Singing in the masque" refers to a frontal tonal placement conceptualized by singers as being associated with vibration of the bones of the face. It is generally regarded as a healthy placement associated with rich resonant characteristics and commonly a strong singer's formant (or "ring")

mechanical equilibrium: The state in which all forces acting on a body cancel each other out, leaving a zero net force in all directions

mechanics: The study of objects in motion and the forces that produce the motion

medial (or mesial): Toward the center (midline or midplane)

melisma: Two or more notes sung on a single syllable

menopause: Cessation of menstrual cycles and menstruation. Associated with physiologic infertility

menstrual cycle: The normal, cyclical variation of hormones in adult females of child-bearing age, and bodily responses caused by those hormonal variations

menstrual period: The first part of the menstrual cycle, associated with endometrial shedding and vaginal bleeding

messa di voce: Traditional exercise in Italian singing tradition consisting of a long prolonged crescendo and diminuendo on a sustained tone

metastasis: Spread of tumor to locations other than the primary tumor site

mezzo soprano: Literally means "half soprano." This is a common female range, higher than contralto but lower than soprano

mezza voce: Literally means "half voice." In practice, means singing softly, but with proper support

middle (or mixed): A mixture of qualities from various voice registers, cultivated in order to allow consistent quality throughout the frequency range

middle C: C₄ on the piano keyboard, with an international concert pitch frequency of 261.6 Hz

millisecond: One thousandth of a second; usually noted ms. or msec

modulation: Periodic variation of a signal property; for example, as vibrato corresponds to a regular variation of fundamental frequency, it can be regarded as a modulation of that signal property

motor: Having to do with motion. For example, motor nerves allow structures to move

motor unit: A group of muscle fibers and the single motor nerve that activates the fibers

mucocele: A benign lesion filled with liquid mucus

mucoytic: A substance that thins mucous secretions

mucosa: The covering of the surfaces of the respiratory tract, including the oral cavity and nasal cavities, as well as the pharynx, larynx, and lower airways. Mucosa also exists elsewhere, such as on the lining of the vagina

mucosal tear: With reference to the vocal folds, disruption of the surface of the vocal fold. Usually caused by trauma

mucosal wave: Undulation along the vocal fold surface traveling in the direction of the airflow

modulation: The systematic change of a cyclic parameter, such as amplitude or frequency

momentum: Mass times velocity; a quantity that determines the potential force that an object can impart to another object by collision

muscle fascicles: Groups of muscle fibers enclosed by a sheath of connective tissue

muscle fibers: A long, thin cell; the basic unit of a muscle that is excited by a nerve ending

muscle tension dysphonia: Also called muscular tension dysphonia. A form of voice abuse characterized by excessive muscular effort, and usually by pressed phonation. A form of voice misuse

mutational dysphonia: A voice disorder. Most typically, it is characterized by persistent falsetto voice after puberty in a male. More generally, it is used to refer to voice with characteristics of the opposite gender

myasthenia gravis: A neuromuscular junction disease associated with fatigue

myoelastic-aerodynamic theory of phonation: The currently accepted mechanism of vocal fold physiology. Compressed air exerts pressure on the undersurface of the closed vocal folds. The pressure overcomes adductory forces, causing the vocal folds to open. The elasticity of the displaced tissues (along with the Bernoulli effect) causes the vocal folds to snap shut, resulting in sound

myofibril: A subdivision of a muscle fiber; composed of a number of myofilaments

myofilament: A microstructure of periodically arranged actin and myosin molecules; a subdivision of a myofibril

myosin: A protein molecule that reacts with actin to form actinomyosin, the contractile part of a myofilament

nasal tract: Air cavity system of the nose

NATS: National Association of Teachers of Singing

natural oscillation: Oscillation without imposed driving forces

neoplasm: Abnormal growth. May be benign or malignant

nervous system: Organs of the body including the brain, spinal cord, and nerves. Responsible for motion, sensation, thought, and control of various other bodily functions

neurotologist: Otolaryngologist specializing in disorders of the ear and ear-brain interface (including the skull base), particularly hearing loss, dizziness, tinnitus, and facial nerve dysfunction

neutral vowel: A vowel produced in the center of the oral cavity

nodes: The “valleys” in a standing wave pattern

nodules: Benign growths on the surface of the vocal folds. Usually paired and fairly symmetric. They are generally caused by chronic, forceful vocal fold contact (voice abuse)

noise: Unwanted sound

noise-to-harmonic ratio (NHR): A general evaluation of noise percent in the signal and includes jitter, shimmer, and turbulent noise

nonlinear dynamics: (*See also Chaos and Chaotic behavior*) The mathematical study of aperiodic, deterministic systems that are not random and cannot be described accurately by linear equations. The study of nonlinear systems whose state changes with time

nonlinear system: Any system in which the output is disproportionate to the input

objective assessment: Demonstrable, reproducible, usually quantifiable evaluation, generally relying on instrumentation or other assessment techniques that do not involve primarily opinion, as opposed to subjective assessment

octave: Interval between 2 pitches with frequencies in the ratio of 2:1

off-glide: Transition from a vowel of long duration to one of short duration

olfaction: The sense of smell, mediated by the first cranial nerve

on-glide: Transition from a sound of short duration to a vowel of longer duration

onset: The beginning of phonation

open quotient: The ratio of the time the glottis is open to the length of the entire vibratory cycle

oral contraceptive: Birth control pill

organic disorder: A disorder due to structural malfunction, malformation, or injury, as opposed to psychogenic disorders

organic voice disorder: Disorder for which a specific anatomic or physiologic cause can be identified, as opposed to psychogenic or functional voice disorders

origin: The beginning point of a muscle and related soft tissue

oscillation: Repeated movement, back and forth

oscillator: With regard to the larynx, the vibrator that is responsible for the sound source, specifically the vocal folds

ossicle: Middle ear bone

ossify: To become bony

ostium: Opening

otolaryngologist: Ear, nose, and throat physician

otologist: Otolaryngologist specializing in disorders of the ear

overtone: Partial above the fundamental in a spectrum

ovulation: The middle of the menstrual cycle, associated with release of an ovum (egg), and the period of fertility

palatal: Related to the palate (*See also* **Linguapalatal**)

papillomas: Small benign epithelial tumors that may appear randomly or in clusters on the vocal folds, larynx, and trachea and elsewhere in the body. Believed to be caused by various types of human papillomavirus (HPV), some of which are associated with malignancy

parietal pleura: The outermost of 2 membranes surrounding the lungs

partial: Sinusoid that is part of a complex tone; in voiced sounds, the partials are harmonic implying that the frequency of the n th partial equals n times the fundamental frequency

particle: A finite mass with zero dimensions, located at a single point in space

pascal (Pa): International standard unit of pressure; 1 newton (N) per meter squared (m^2)

Pascal's law: Pressure is transmitted rapidly and uniformly throughout an enclosed fluid at rest

pass band: A band of frequencies minimally affected by a filter

passaggio (Italian): The break between vocal registers

period: (1) In physics, the time interval between repeating events; shortest pattern repeated in a regular undulation; a graph showing the period is called a waveform. (2) In medicine, the time during the menstrual cycle associated with bleeding and shedding of the endometrial lining

period doubling: One form of bifurcation in which a system that originally had x period states now has $2x$ periodic states, with a change having occurred in response to a change in parameter or initial condition

period time: In physics, duration of a period

periodic behavior: Repeating over and over again over a finite time interval. Periodic behavior is governed by an underlying deterministic process

peristalsis: Successive contractions of musculature, which cause a bolus of food to pass through the alimentary tract

perturbation: Small disturbances or changes from expected behavior

pharyngocele: A pouch or herniation of part of the pharynx (throat), commonly fills with air in wind players

pharynx: The region above the larynx, below the velum and posterior to the oral cavity

phase: (1) The manner in which molecules are arranged in a material (gas, liquid, or solid); (2) the angular separation between 2 events on periodic waveforms

phase plane plot: Representation of a dynamic system in state space

phase space: A space created by 2 or more independent dynamic variables, such as positions and velocities, utilized to plot the trajectory of a moving object

phase spectrum: A display of the relative phases vs frequency of the components of a waveform

phonation: Sound generation by means of vocal fold vibrations

phoneme: A unit of sound within a specific language

phonetics: The study of speech sounds

phonetogram: Recording of highest and lowest sound pressure level vs fundamental frequency that a voice can produce; phonetograms are often used

for describing the status of voice function in patients. Also called *voice range profile*

phoniatician: A physician specializing in diagnosis and nonsurgical treatment of voice disorders. This specialty does not exist in American medical training, where the phoniatician's activities are accomplished as a team by the laryngologist (responsible for diagnosis and surgical treatment when needed) and speech-language pathologist (responsible for behavioral voice therapy)

phonosurgery: Originally, surgery designed to alter vocal quality or pitch. Now used commonly to refer to all delicate microsurgical procedures of the vocal folds

phonotrauma: Vocal fold injury caused by vocal fold contact during phonation, associated most commonly with voice abuse or misuse

phrenic nerve: The nerve that controls the diaphragm. Responsible for inspiration. Composed primarily of fibers from the third, fourth, and fifth cervical roots

piriform sinus: Pouch or cavity constituting the lower end of the pharynx located to the side and partially to the back of the larynx. There are 2, paired pyriform sinuses in the normal individual

pitch: Perceived tone quality corresponding to its fundamental frequency

pitch matching: Experiment in which subjects are asked to produce the pitch of a reference tone

pitch period perturbation quotient (PPQ): A relative evaluation of short-term (cycle-to-cycle) variation of the pitch periods expressed in percent

pleural space: The fluid-filled space between the parietal and visceral pleura

plosive: A consonant produced by creating complete blockage of airflow, followed by the buildup of air pressure, which is then suddenly released, producing a consonant sound

Poincaré section: A graphical technique to reveal a discernable pattern in a phase plane plot that does not have an apparent pattern. There are 2 kinds of Poincaré sections

polyp: A sessile or pedunculated growth. Usually unilateral and benign, but the term is descriptive and does not imply a histological diagnosis

posterior: Toward the back

posterior cricoarytenoid muscle: An intrinsic laryngeal muscle that is the primary abductor of the vocal folds (paired)

power: The rate of delivery (or expenditure) of energy (measured in watts)

power source: The expiratory system including the muscles of the abdomen, back, thorax, and the lungs. Responsible for producing a vector of force that results in efficient creation and control of subglottal pressure

power spectrum: Two-dimensional graphic analysis of sound with frequency on the *x* axis and amplitude on the *y* axis

prechaotic behavior: Predictable behavior prior to the onset of chaotic behavior. One example is period doubling

pressed phonation: Type of phonation characterized by small airflow, high adductory force, and high subglottal pressure. Not an efficient form of voice production. Often associated with voice abuse, and common in patients with lesions such as nodules

pressure: Force per unit area

prevoicing: Phonation that occurs briefly before phonation of a stop consonant

prima donna: Literally means "first lady." Refers to the soprano soloist, especially the lead singer in an opera

primo passaggio: "The first passage"; the first register change perceived in a voice as pitch is raised from low to high

proteomics: The study of proteins

psychogenic: Caused by psychological factors, rather than physical dysfunction. Psychogenic disorders may result in physical dysfunction or structural injury

pulmonary system: The breathing apparatus including the lungs and related airways

pulse register: The extreme low end of the phonatory range. Also known as *vocal fry* and *Stroh bass*, characterized by a pattern of short glottal waves alternating with larger and longer ones, and with a long closed phase

pure tone: Sinusoid. The simplest tone. Produced electronically. In nature, even pure-sounding tones like bird songs are complex

pyrosis: Heartburn

pyrotechnics: Special effects involving combustion and explosion, used to produce dramatic visual displays (similar to fireworks), indoors or outdoors

quadrangular membrane: Elastic membrane extending from the sides of the epiglottic cartilage to the cor-

niculate and arytenoid cartilages. Mucosa covered. Forms the aryepiglottic fold and the wall between the piriform sinus and larynx

quasiperiodic: A behavior that has at least 2 frequencies in which the phases are related by an irrational number

radian: The angular measure obtained when the arc along the circumference of the circle is equal to the radius

radian frequency: The number of radians per second covered in circular or sinusoidal motion

random behavior: Action that never repeats itself and is inherently unpredictable

rarefaction: A decrease in density

recurrent laryngeal nerves: The paired branches of the vagus nerve that supply all of the intrinsic muscles of the larynx except for the cricothyroid muscles. The recurrent laryngeal nerves also carry sensory fibers (feeling) to the mucosa below the level of the vocal folds

reflux: (*See Gastroesophageal reflux and Laryngopharyngeal reflux*)

reflux laryngitis: Inflammation of the larynx due to irritation from gastric juice

refractive eye surgery: Surgery to correct visual acuity

registers: Weakly defined term for vocal qualities; often, register refers to a series of adjacent tones on the scale that sound similar and seem to be generated by the same type of vocal fold vibrations and vocal tract adjustments. Examples of register are vocal fry, modal, and falsetto; but numerous other terms are also used

regulation: The events by which a protein is produced or destroyed, and the balance between these 2 conditions

Reinke's space: The superficial layer of the lamina propria

relative average perturbation (RAP): A relative evaluation of short-term (cycle-to-cycle) variation of the pitch periods expressed in percent

relative voice rest: Restricted, cautious voice use

resonance: Peak occurring at certain frequencies (resonance frequencies) in the vibration amplitude in a system that possesses compliance, inertia, and reflection; resonance occurs when the input and the reflected energy vibrate in phase; the resonances in the vocal tract are called *formants*

resonator: With regard to the voice, refers primarily to the supraglottic vocal tract, which is responsible for timbre and projection

restoring force: A force that brings an object back to a stable equilibrium position

return map: Similar to phase plane plot, but analyzed data must be digital. This graphic technique represents the relationship between a point and any subsequent point in a time series

rhinorrhea: Nasal discharge; runny nose

rhotic: A vowel sound produced with r-coloring

rima glottidis: The space between the vocal folds. Also known as the glottis

roll-off: Characteristics of filters specifying their ability to shut off frequencies outside the pass band; for example, if a low pass filter is set to 2 kHz and has a roll-off of 24 dB/octave, it will alternate a 4 kHz tone by 24 dB and a 8 kHz ton

singer's formant: A high spectrum peak occurring between about 2.3 and 3.5 kHz in voiced sounds in Western opera and concert singing. This acoustic phenomenon is associated with "ring" in a voice, and with the voice's ability to project over background noise such as a choir or an orchestra. A similar phenomenon may be seen in speaking voices, especially in actors. It is known as the *speaker's formant*

singing teacher: Professional who teaches singing technique (as opposed to Voice coach).

singing voice specialist: A singing teacher with additional training, and specialization in working with injured voices, in conjunction with a medical voice team

sinus of Morgagni: Often confused with ventricle of Morgagni. Actually, the sinus of Morgagni is not in the larynx. It is formed by the superior fibers of the superior pharyngeal constrictor as they curve below the levator veli palatini and the eustachian tube. The space between the upper border of the muscle and the base of the skull is known as the sinus of Morgagni, and is closed by the pharyngeal aponeurosis

sinusitis: Infection of the paranasal sinus cavities

sinusoid: A graph representing the sine or cosine of a constantly increasing angle; in mechanics, the smoothest and simplest back-and-forth movement, characterized by a single frequency, an amplitude, and a phase; tone arising from sinusoidal sound pressure variations

sinusoidal motion: The projection of circular motion (in a plane) at constant speed onto one axis in the plane

skeleton: The bony or cartilaginous framework to which muscle and other soft tissues are attached

smoothed amplitude perturbation quotient (sAPQ): A relative evaluation of long-term variation of the peak-to-peak amplitude within the analyzed voice sample, expressed in percent

smoothed pitch perturbation quotient (sPPQ): A relative evaluation of long-term variation of the pitch period within the analyzed voice sample expressed in percent

soft glottal attack: Gentle glottal approximation, often obtained using an imaginary /h/

soft phonation index (SPI): A measure of the ratio of lower frequency harmonic energy to higher frequency harmonic energy. If the SPI is low, then the spectral analysis will show well-defined higher formants

solid: A substance that maintains its shape, independent of the shape of its container

soprano acuto: High soprano

soprano assoluto: A soprano who is able to sing all soprano roles and classifications

sound level: Logarithmic, comparative measure of the intensity of a signal; the unit is dB

sound pressure level (SPL): Measure of the intensity of a sound, ordinarily in dB relative to 0.0002 microbar (millionths of 1 atmosphere pressure)

sound propagation: The process of imparting a pressure or density disturbance to adjacent parts of a continuous medium, creating new disturbances at points farther away from the initial disturbance

source-filter theory: A theory that assumes the time-varying glottal airflow to be the primary sound source and the vocal tract to be an acoustic filter of the glottal source

source spectrum: Spectrum of the voice source

spasmodic dysphonia: A focal dystonia involving the larynx. May be of adductor, abductor, or mixed type. Adductor spasmodic dysphonia is characterized by strain-strangled interruptions in phonation. Abductor spasmodic dysphonia is characterized by breathy interruptions

speaker's formant: (*See Singer's formant*)

special sensory nerves: Nerves responsible for hearing, vision, taste, and smell

spectrogram: Three-dimensional graphic representation of sound with time on the *x* axis, frequency on the *y* axis, and amplitude displayed as intensity of color

spectrograph: The equipment that produces a spectrogram

spectrum: Ensemble of simultaneously sounding sinusoidal partials constituting a complex tone; a display of relative magnitudes or phases of the component frequencies of a waveform

spectrum analysis: Analysis of a signal showing its partials

speech-language pathologist: A trained, medically affiliated professional who may be skilled in remediation of problems of the speaking voice, swallowing, articulation, language development, and other conditions

speed: The rate of change of distance with time; the magnitude of velocity

spinto: Literally means *pushed* or *thrust*. Usually applies to tenors or sopranos with lighter voice than dramatic singers, but with aspects of particular dramatic excitement in their vocal quality. Enrico Caruso was an example

spirometer: A device for measuring airflow

stable equilibrium: A unique state to which a system with a restoring force will return after it has been displaced from rest

staccato: Each note accented and separated

standard deviation: The square root of the variance

standing wave: A wave that appears to be standing still; it occurs when waves with the same frequency (and wavelength) moving in opposite directions interfere with each other

state space: In abstract mathematics, the area in which a behavior occurs

stent: A device used for shape, support, and maintenance of patency during healing after surgery or injury

steroid: Steroids are potent substances produced by the body. They may also be consumed as medications. (See also **Anabolic steroids**, **Corticosteroids**)

stochastic: Random from a statistical, mathematical point of view

stop band: A band of frequencies rejected by a filter; it is the low region in a filter spectrum

strain: Deformation relative to a rest dimension, including direction (eg, elongation per unit length)

strain rate: The rate of change of strain with respect to time

stress: Force per unit area, including the direction in which the force is applied to the area

striking zone: The middle third of the musculo-membranous portion of the vocal fold; the point of maximum contact force during phonatory vocal adduction

stroboscopy: A technique that uses interrupted light to simulate slow motion. (See also **Strobvideolaryngoscopy**)

strobvideolaryngoscopy: Evaluation of the vocal folds utilizing simulated slow motion for detailed evaluation of vocal fold motion

Stroh bass (German): "Straw bass"; another term for *pulse register* or *vocal fry*

subglottal: Below the glottis

subglottal pressure: Air pressure in the airway immediately below the level of the vocal folds. The unit most commonly used is centimeters of water. That distance in centimeters that a given pressure would raise a column of water in a tube

subglottic: The region immediately below the level of the vocal folds

subharmonic: A frequency obtained by *dividing* a fundamental frequency by an integer greater than 0

subjective assessment: Evaluation that depends on perception and opinion, rather than independently reproducible quantifiable measures, as opposed to objective assessment

sulcus vocalis: A longitudinal groove, usually on the medial surface of the vocal fold

superior: above

superior laryngeal nerves: Paired branches of the vagus nerve that supply the cricothyroid muscle and supply sensation from the level of the vocal folds superiorly

support: Commonly used to refer to the power source of the voice. It includes the mechanism responsible for creating a vector force that results in efficient subglottic pressure. This includes the muscles of the abdomen and back, as well as the thorax and lungs; primarily the expiratory system

supraglottal: Above the glottis, or level of the vocal folds

supraglottic: (1) Above the level of the vocal folds. This region includes the resonance system of the vocal tract, including the pharynx, oral cavity, nose, and related structures. (2) Posterior commissure. A misnomer. Used to describe the posterior aspect of the larynx (interarytenoid area), which is opposite the anterior commissure. However, there is actually no commissure on the posterior aspect of the larynx

suprahyoid muscle group: One of the 2 extrinsic muscle groups. Includes the stylohyoid muscle, anterior and posterior bellies of the digastric muscle, geniohyoid, hyoglossus, and mylohyoid muscles

temporal gap transition: The transition from a continuous sound to a series of pulses in the perception of vocal registers

temporomandibular joint: The jaw joint; a synovial joint between the mandibular condyle and skull anterior to the ear canal

tenor: Highest of the male voices, except countertenors. Must be able to sing to C₅. Singer's formant is around 2800 Hz

tenore serio: Dramatic tenor

testosterone: The hormone responsible for development of male sexual characteristics, including laryngeal growth

thin voice: A term used by singers to describe vocal weakness associated with lack of harmonic richness. The voice often also has increased breathiness, noise, and weakness and is commonly also described as "thready"

thoracic: Pertaining to the chest

thorax: The part of the body between the neck and abdomen

thready voice: (*See Thin voice*)

thyroarytenoid muscle: An intrinsic laryngeal muscle that comprises the bulk of the vocal fold (paired). The medial belly constitutes the body of the vocal fold

thyroid cartilage: The largest laryngeal cartilage. It is open posteriorly and is made up of 2 plates (thyroid laminae) joined anteriorly at the midline. In males, there is a prominence superiorly known as the "Adam's apple"

tidal volume: The amount of air breathed in and out during respiration (measured in liters)

timbre: The quality of a sound. Associated with complexity, or the number, nature, and interaction of overtones

tonsil: A mass of lymphoid tissue located near the junction of the oral cavity and pharynx (paired)

tonsillitis: Inflammation of the tonsil

tracheal stenosis: Narrowing in the trachea. May be congenital or acquired

tracheoesophageal fistula: A connection between the trachea and esophagus. May be congenital or acquired

trajectory: In chaos, the representation of the behavior of a system in state space over a finite, brief period of time. For example, one cycle on a phase plane plot

transcription: Converting the message in DNA to messenger RNA

transfection: Infection by naked viral nucleic acid

transglottal flow: Air that is forced through the glottis by a transglottal pressure

transition: With regard to the vocal fold, the intermediate and deep layers of lamina propria (vocal ligament)

translation: Using messenger RNA to make proteins

transverse: Refers to an anatomic plane that divides the body across. Also used to refer to a direction perpendicular to a given structure or phenomenon such as a muscle fiber or airflow

tremolo: An aesthetically displeasing, excessively wide vibrato (*See also Wobble*). The term is also used in music to refer to an ornament used by composers and performers

tremor: A modulation in activity

trill: In early music (Renaissance) where it referred to an ornament that involved repetition of the same note. That ornament is now referred to as a *trillo*

trillo: Originally a trill, but in recent pedagogy a rapid repetition of the same note, which usually includes repeated voice onset and offset

triphthong: Three consecutive vowels that make up the same syllable

tumor: A mass or growth

turbulence: Irregular movement of air, fluid, or other substance, which causes a hissing sound. White water is a typical example of turbulence

turbulent airflow: Irregular airflow containing eddies and rotating patterns

tympanic membrane: Eardrum

unilatera

velocity: The rate of change of displacement with respect to time (measured in meters per second, with the appropriate direction)

velopharyngeal insufficiency: Escape of air, liquid, or food from the oropharynx into the nasopharynx or nose at times when the nasopharynx should be closed by approximation of the soft palate and pharyngeal tissues

velum: The area of the soft palate and adjacent nasopharynx

ventral: Toward the belly

ventricle of Morgagni: Also known as *laryngeal sinus*, and *ventriculus laryngis*. The ventricle is a fusiform pouch bounded by the margin of the vocal folds, the edge of the free crescentic margin of the false vocal fold (ventricular fold), and the mucous membrane between them that forms the pouch. Anteriorly, a narrowing opening leads from the ventricle to the appendix of the ventricle of Morgagni

ventricular folds: The “false vocal folds,” situated above the true vocal folds

ventricular ligament: A narrow band of fibrous tissue that extends from the angle of the thyroid cartilage below the epiglottis to the arytenoid cartilage just above the vocal process. It is contained within the false vocal fold. The caudal border of the ventricular ligament forms a free crescentic margin, which constitutes the upper border of the ventricle of Morgagni

ventricular phonation: (See **Dysphonia plica ventricularis**)

vertical phase difference: With reference to the vocal folds, refers to the asynchrony between the lower and upper surfaces of the vibratory margin of the vocal fold during phonation

vertigo: Sensation of rotary motion. A form of dizziness

vibrato: In classical singing, vibrato is a periodic modulation of the frequency of phonation. Its regularity increases with training. The rate of vibrato (number of modulations per second) is usually in the range of 5 to 6 per second. Vibrato rates over 7 to 8 per second are aesthetically displeasing to most people, and sound “nervous.” The extent of vibrato (amount of variation above and below the center frequency) is usually 1 or 2 semitones. Vibrato rates extending less than ± 0.5 semitone are rarely seen in singers although they are encountered in wind instrument playing. Vibrato rates greater than 2 semitones are usually aesthetically unacceptable, and are typical

of elderly singers in poor artistic vocal condition, in whom the excessively wide vibrato extent is often combined with excessively slow rate

viscera: The internal organs of the body, particularly the contents of the abdomen

visceral pleura: The innermost of 2 membranes surrounding the lungs

viscoelastic material: A material that exhibits characteristics of both elastic solids and viscous liquids. The vocal fold is an example

viscosity: Property of a liquid associated with its resistance to deformation. Associated with the “thickness” of a liquid

vital capacity: The maximum volume of air that can be exchanged by the lungs with the outside; it includes the expiratory reserve volume, tidal volume, and inspiratory reserve volume (measured in liters)

vocal cord: Old term for vocal fold

vocal fold stiffness: The ratio of the effective restoring force (in the medial-lateral direction) to the displacement (in the same direction)

vocal fold (or cord) stripping: A surgical technique, no longer considered acceptable practice under most circumstances, in which the vocal fold is grasped with a forceps, and the surface layers are ripped off

vocal folds: A paired system of tissue layers in the larynx that can oscillate to produce sound

vocal fry: A register with perceived temporal gaps; also known as *pulse register* and *Stroh bass*. (See also **Pulse register**)

vocal ligament: Intermediate and deep layers of the lamina propria. Also forms the superior end of the conus elasticus

vocal tract: Resonator system constituted by the larynx, the pharynx, and the mouth cavity

vocalis muscle: The medial belly of the thyroarytenoid muscle

vocalise: A vocal exercise involving sung sounds, commonly vowels on scales of various complexity

voce coperta: “Covered registration”

voce mista: Mixed voice (also *voix mixed*)

voce di petto: Chest voice

voce piena: Full voice

voce sgangherata: "White" voice. Literally means immoderate or unattractive. Lacks strength in the lower partials

voce di testa: Head voice

voice abuse: Use of the voice in specific activities that are deleterious to vocal health, such as screaming

voice box: (*See Larynx*)

voice coach: (1) In singing, a professional who works with singers, teaching repertoire, language pronunciation, and other artistic components of performance (as opposed to a singing teacher, who teaches technique); (2) The term *voice coach* is also used by acting-voice teachers who specialize in vocal, bodily, and interpretive techniques to enhance dramatic performance

voice misuse: Habitual phonation using phonatory techniques that are not optimal and then result in vocal strain. For example, speaking with inadequate support, excessive neck muscle tension, and suboptimal resonance. Muscular tension dysphonia is a form of voice misuse

voice range profile: (*See Phonetogram*)

voice rest: (*See Absolute voice rest, relative voice rest*)

voice source: Sound generated by the pulsating transglottal airflow; the sound is generated when the vocal fold vibrations chop the airstream into a pulsating airflow

voice turbulence index (VTI): A measure of the relative energy level of high-frequency noise

voiced: A language sound made with phonation, and possessing pitch

voiceless: (*See Unvoiced*)

volume: "Amount of sound," best measured in terms of acoustic power or intensity

vortex theory: Holds that eddies, or areas of organized turbulence, are produced as air flows through the larynx and vocal tract

Vowel color: Refers to vowel quality, or timbre, and is associated with harmonic content

Waldeyer's ring: An aggregation of lymphoid tissue in the pharynx, including the tonsils and adenoids

waveform: A plot of any variable (eg, pressure, flow, or displacement) changing as time progresses along the horizontal axis; also known as a time-series

wavefront: The initial disturbance in a propagating wave

wavelength: The linear distance between any point on one vibratory cycle and a corresponding point of the next vibratory cycle

whisper: Sound created by turbulent glottal airflow in the absence of vocal fold vibration

whistle register: The highest of all registers (in pitch). It is observed only in females, extending the pitch range beyond F_6

wobble: Undesirable vibrato, usually with vibrato rate of 2 to 4 Hz, and extent greater than ± 0.5 semitone (*See also Tremolo*)

xerostomia: Dry mouth

Young's modulus: The ratio between magnitudes of stress and strain