

# Considerations for the Professional Voice User-Singer-Performer

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## Disclosures

- No relevant disclosures

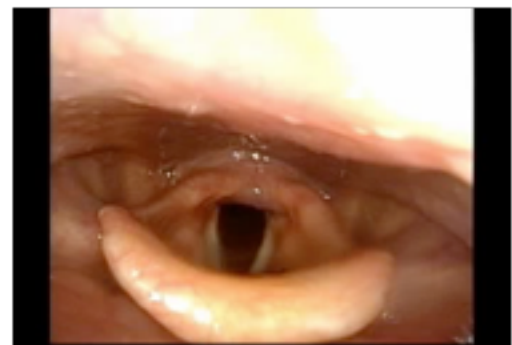


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## Happy World Voice Day!



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## Jennifer Bergeron, MD Soprano



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## Care of the Voice Professional

- Professional Voice: a category that includes professional singers, actors, voice-over artists, and radio hosts, as well as teachers, phone operators, lawyers, salespeople, and even doctors.
  - Any profession where verbal communication is required.
- A thorough history and careful physical exam are required, as well as complete understanding of the psychosocial situation of the patient and daily voice needs.
- For singers, it is important to having a working knowledge of singing mechanism, vocal styles, and performer demands.



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# Assessment of the Singing Professional

## History:

- Complete medical, surgical, and social history.
- What is the problem you are having with the voice?
  - Range, fatigue, pitch instability, voice transitions, volume, pain, etc.?
- What type of singing do you do? Where?
- Are you rehearsing or in performance? Upcoming?
- Have you had any formal training? Currently?
- What are your daily vocal demands? In addition to singing?
- Do you have allergies, breathing problems, acid reflux?
- Do you smoke or are you exposed to smoke?

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# Assessment of the Singing Professional

## Exam:

- Listen to the voice from the time the patient enters.
- Complete head & neck exam with neuro exam.
- Laryngoscopy with stroboscopy, flexible and/or rigid.
  - Neurologic challenge
  - Singing problematic song or passage
  - Stroboscopy
- Acoustic and aerodynamic measurements by SLP

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# Singing Physiology & Terminology

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# Vocal Subsystems

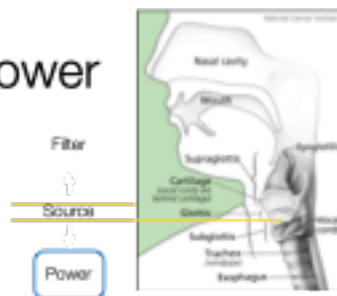
- Actuators (Power): Respiratory System
  - Air from the lungs provides the power for the voice
- Vibrator (Source): Vocal Folds (Cords)
  - Within the larynx (voice box)
  - Creation of a sound wave
- Resonators (Filter): Vocal Tract
  - Supraglottis, pharynx, mouth, lips, teeth, nasal cavity, sinuses
  - Modification of sound into tones of varying "colors" (called timbre)
  - Articulation



<https://www.flickr.com/photos/gainraby/5821103798/>

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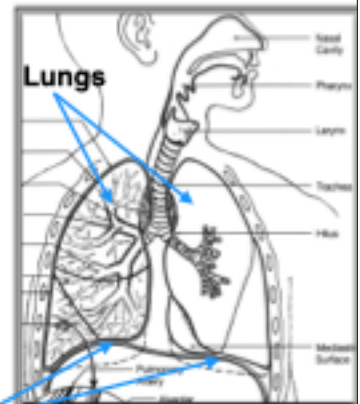
# Actuator - Power



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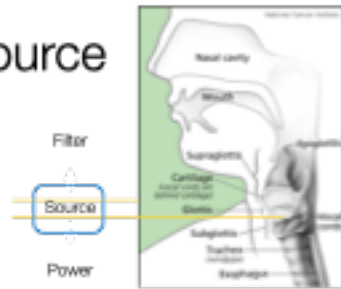
# Respiratory System

- Inhalation:
  - Diaphragm contracts
  - Abdominal muscles relax
  - Intercostal muscles raise chest
- Exhalation:
  - Diaphragm relaxes
  - Abdominal muscles contract
  - Chest falls



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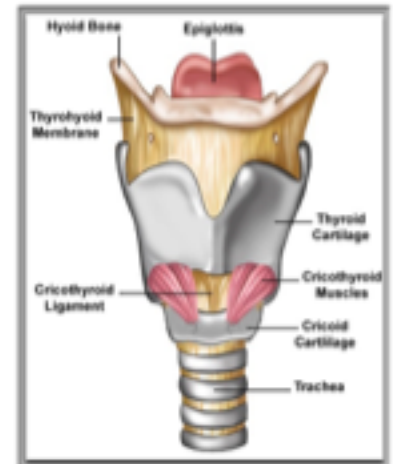
## Vibrator - Source



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## Larynx Anatomy

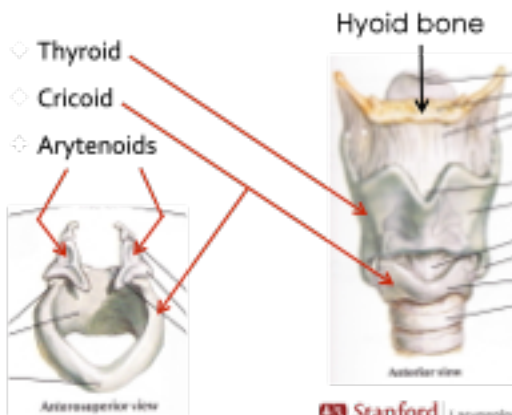
- Skeleton
- Mucosa
- Muscles



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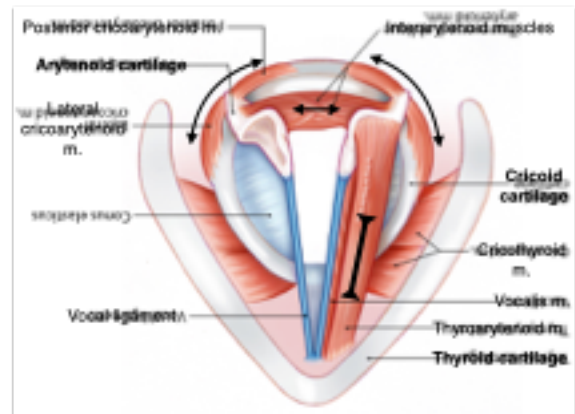
## Laryngeal Cartilages

- ◇ Thyroid
- ◇ Cricoid
- ◇ Arytenoids



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## Laryngeal Muscles



Courtesy Chris Gralapp

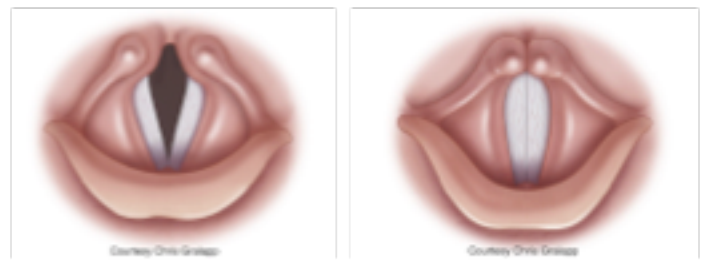
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## Intrinsic Muscles

- Alter position and shape of the vocal folds
- **Adduction - vocal folds come together (vocalizing)**
  - Thyroarytenoid (TA) and vocalis
  - Lateral cricoarytenoid (LCA)
  - Intercricoid
- **Abduction - vocal folds move apart (inspiration)**
  - Posterior cricoarytenoid (PCA)

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## Laryngeal Abduction & Adduction



ABducted

ADducted

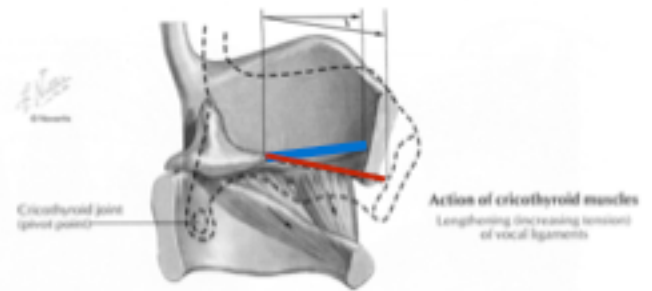
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## Extrinsic & Accessory Muscles

- **Extrinsic Muscles**
  - Cricothyroid (CT) - Stretch and tighten the vocal folds
  - Primary means for controlling pitch
- **Accessory Muscles**
  - Suprahyoid (above the hyoid)
    - Elevate the larynx
  - Infrahyoid (below the hyoid)
    - Depress the larynx

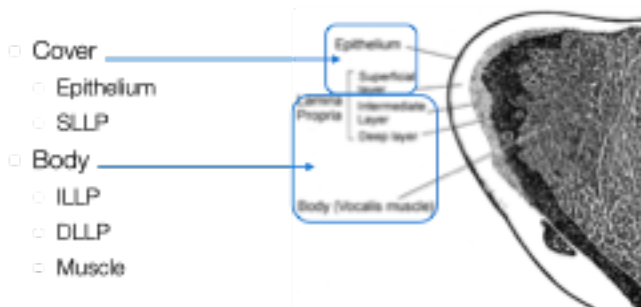
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## Stretching the Vocal Fold



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## Layers of the Vocal Fold



From www.british-voice-association.com

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## Vibration

- Vocal folds vibrate against each other hundreds of times per second
- Series of small "puffs of air"
- "Buzzing" sound
- Fundamental frequency (F0): The number of times the vocal folds vibrate / second
- Measured in Hertz (Hz)

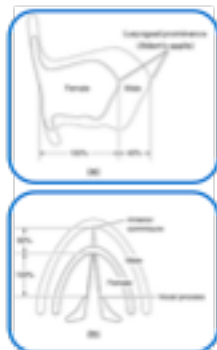


From Selkel et al. (2010) p. 236

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## Factors Influencing F0

- Fundamental Frequency = F0
- F0 determines vocal pitch
  - Female F0: ~200 Hz
  - Male F0: ~125 Hz
- F0 influences
  - Laryngeal size
  - Effective length of vibrating vocal fold



From www.novs.org

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## Fach System

- Fach - method of classifying singers, primarily opera singers, according to the range, weight, and color of their voices.
  - Soprano
  - Mezzo-soprano
  - Contralto
  - Tenor
  - Baritone
  - Bass

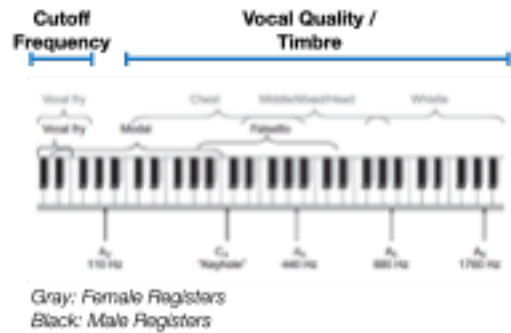
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# Mechanisms of Voice

- How does one set of vocal folds cover such a wide range of pitches?
  - Mechanism 0 (M0) - called 'creak' or 'vocal fry'
  - Mechanism 1 (M1) - 'chest' voice in women, normal voice in men
  - Mechanism 2 (M2) - 'head' voice in women, 'falsetto' voice in men
  - Mechanism 3 (M3) - 'whistle' register in women

Wolfe J, Ganier M, and Smith J. Voice Acoustics: an Introduction. University of New South Wales, 2012. <http://www.phys.unsw.edu.au/~jw/voice.html#registers>

# Vocal Registers



From Sundberg (2008)

# Vocal Register Features

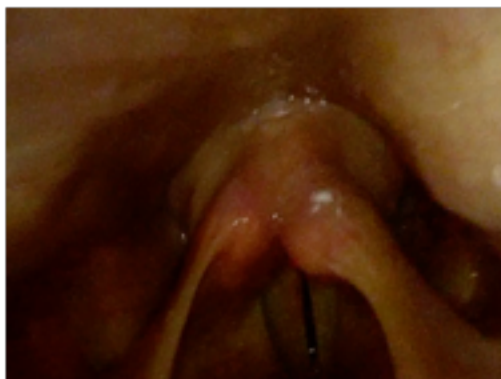
Register	Muscle Active	Vibrating Region of the Vocal Fold	Vocal Quality	Pitch
Vocal Fry	TA Only	Most of the vocal fold	Vocal fry, Pulsating	Lowest, Below normal singing range
Chest (Modal)	Mostly TA, Some CT	Most of the vocal fold, Both cover and body	Heavier, richer tone	Lower part of singing range
Head	Mostly CT, Some TA	Cover only	Lighter, thinner tone	Upper part of singing range
Falsetto	CT Only	Very little, Only outer cover layers	Lightest possible	Highest sung pitches, Above normal range

Adapted from [www.ncvcs.org](http://www.ncvcs.org)

# Modal Register



# Falsetto



# Low Modal Register



## Vocal Fry



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## Passaggio

- Transition area between registers
- Indicators of transition in untrained singers
  - "Breaks" in voice
  - Change in timbre
  - Audible shift in register

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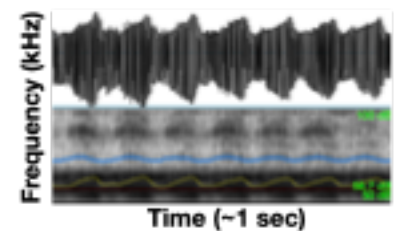
## Passaggio



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## Vibrato

- Modulation in the pitch and loudness of the voice
- Characteristics
  - $\pm 1-2$  semitones
  - 4.5-6.5 undulations / second
  - Volitional - can be controlled by singer



Pitch Modulation: **Blue**  
Loudness Modulation: **Yellow**

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## Vibrato



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## Manipulating Loudness

- Vocal intensity
  - Measure of radiated power
  - Loudness perceptual correlate of intensity
- Intensity control in the larynx
  - Actuator (power): Increase in lung press
  - Vibrator (source): Degree to which vocal folds are adducted
  - Resonators (filter): Selectively boost energy of the vibratory system

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## Manipulating Loudness



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## Manipulating Loudness



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## Patient A

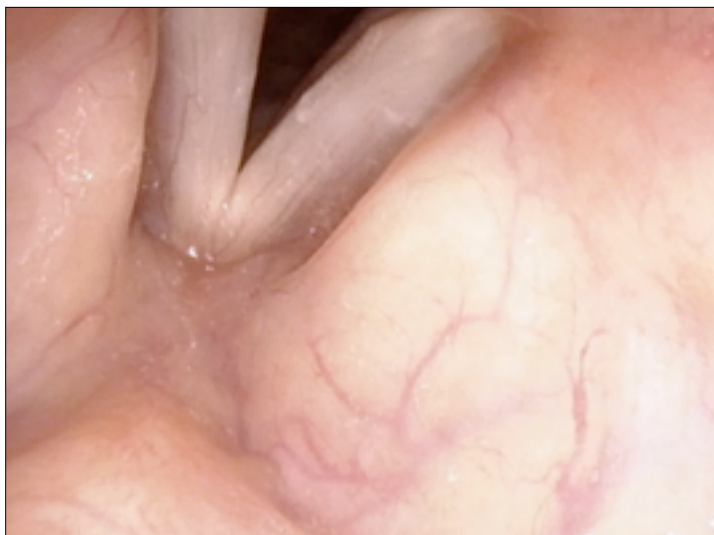
- 28 yo F professional opera singer - coloratura soprano
- Has had trouble with her high register off and on since 2014.
- Diagnosed with reflux 3 yrs ago. Some improvement of voice with PPI and diet/behavior modification. Not 100%.
- 2 yrs ago - large lead role in Pennsylvania. After closing she would wake up with hoarseness. Had trouble with soft high notes.
  - Diagnosed with nodules and put on voice rest x3 wks.
  - Voice improved, but still only 60-70% normal.

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## Patient A

- Currently in rehearsals as the lead in an opera at a small professional company in SF.
  - 2 shows coming up in 3 weeks (one week apart)
  - No understudy available
- C/O trouble with the highest part of her range, vocal fatigue.
- No pain when singing. Has been marking during rehearsals.
- PMH/VPSH: None
- Meds: Tums prn; Advil prn.
- All: NKDA
- SHx: No tobacco or EtOH

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## Patient A

- Differential Diagnosis?
- Treatment plan?

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## Surgical Decision-Making

- o Adequate course of voice therapy? Work with singing teacher?
- o Have we reduced the cause of vocal trauma?
- o Timing of surgery is key.
  - o Voice rest - can the patient take time to rest?
  - o Time to return to singing - start singing 1-2 months post-op.
  - o Time to return performing - return to performance 2-3 months post-op.
- o Expectations - what are the chances the voice will return to "normal?"
  - o Scarring at the surgical site. Trauma or contact lesion on the contralateral TVF.
- o Is the benefit worth the risk of the time off and possible worsening of voice?

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## Patient B

- o 30 yo F professional musical theatre performer (alto, mostly belt), dance teacher, and choreographer.
- o Lost her voice after a series of performances 1.5 yrs ago. Resolved spontaneously with rest.
- o Lost her voice again 1 yr ago, was seen by a laryngologist in NYC and diagnosed with a R VF pseudocyst. Rx'd steroids & sinus rinses.
- o She moved to the Bay Area and 3 mo. later lost her voice again after vocal performances and teaching dance classes.
  - o Given nystatin and Diflucan with some improvement.

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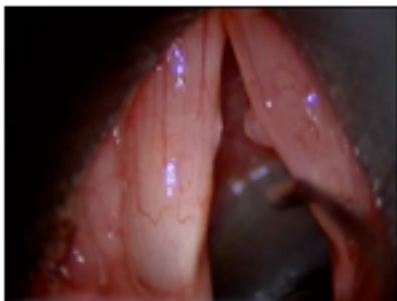
## Patient B

- o 3 mo. ago had her worst episode with vocal weakness, hoarseness, and inability to sing her full range (especially high register) lasting for 3 months.
  - o Rx'd steroids and ranitidine with mild improvement.
- o Will start rehearsals for a national tour in 2.5 months in NYC.
- o PMH/VPSH: Umbilical hernia repair
- o Meds: None
- o All: NKDA
- o SHx: No tobacco. 1-2 drinks/week.

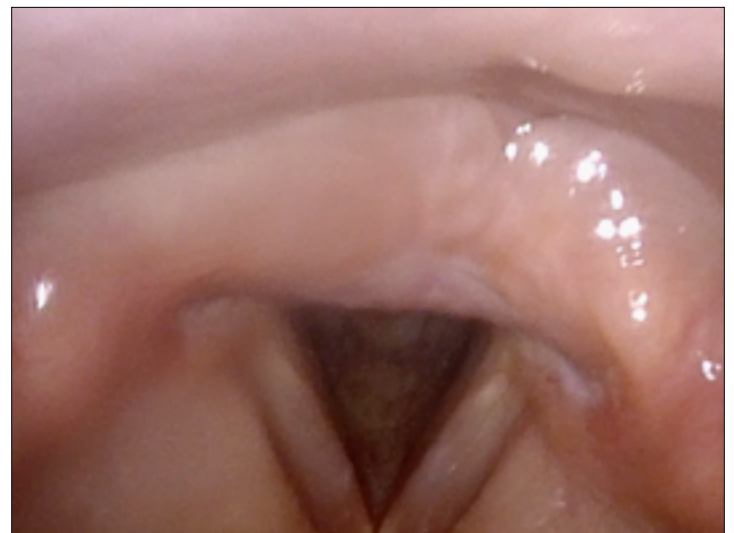
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## Summary

- Care of the voice professional requires a thorough assessment and understanding of the performer's voice history, style, training, career, goals, use patterns, previous injuries, and the current condition.
- The decision as to whether to operate, as well as when to operate, are vitally important.
- Thorough preoperative assessment of the performer's expectations and informed consent is crucial.

## World Voice Day Concert

- Special Guests:
  - Amity Rose
  - Brandon Baird, MD
  - Jonathan Bock, MD



Thank You