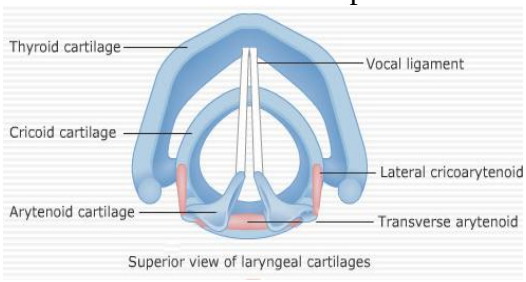
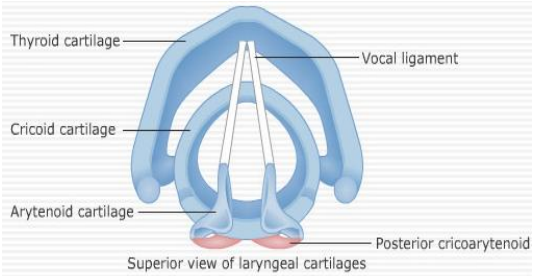
Unit II – Problem 1 – Physiology: Voice Formation

- **The development of neural networks begins at birth and early experiences are crucial. From the age of few months, we learn how to produce sounds and voices.**
- **There are 3 components involved in the production of voice:**
  - **Generation of the sound**: sound is produced by the larynx. expired air against partially closed glottis causes the vibration of vocal cords and this is how sound is produced.
  - **Resonance of the sound**: the tone of the sound which is produced by the vibration of vocal cords will be modified by the following chambers:
    - ✓ Pharynx/mouth.
    - ✓ Nasal sinuses.
    - ✓ Chest cavity.
  - **Articulation of voice النطق-التعبير:** the sound which is produced by the previous two processes will be converted to speech by:
    - ✓ Tongue.
    - ✓ Palate.
    - ✓ Cheek.
    - ✓ Lips.
- **What are the parameters of voice?**
  - **Quality جودة الـ صوت:** it is depends on the symmetrical vibration of vocal cords at the midline of the glottis.
  - **Loudness جهارة الـ صوت: it is influenced by:**
    - ✓ Subglottic pressure.
    - ✓ Glottic resistance.
    - ✓ Transglottic air flow.
    - ✓ Amplitude of vibration (longer vocal cords = louder voice).
  - **Pitch حدة الصوت:** it depends on changes in the length and tension of the vocal cords.
- **The speech is composed of the following:**
  - **Phonation (sound):** abnormalities are known as dysphonia or aphonia.
  - **Articulation (sounds and words):** abnormalities are known as dysarthria or anarthria.
  - **Language (sounds, words and understandable phrases):** abnormalities are known as dysphasia and aphasia.
- **What are the differences of vocal cords between males and females?**

Males	Females
Vibratory part of vocal cords = 16 mm (longer due to androgens; deeper pitch)	Vibratory part of vocal cords = 13 mm
Glottis is closed during phonation	A small opening is present in glottis during phonation (thus they have a softer tone)

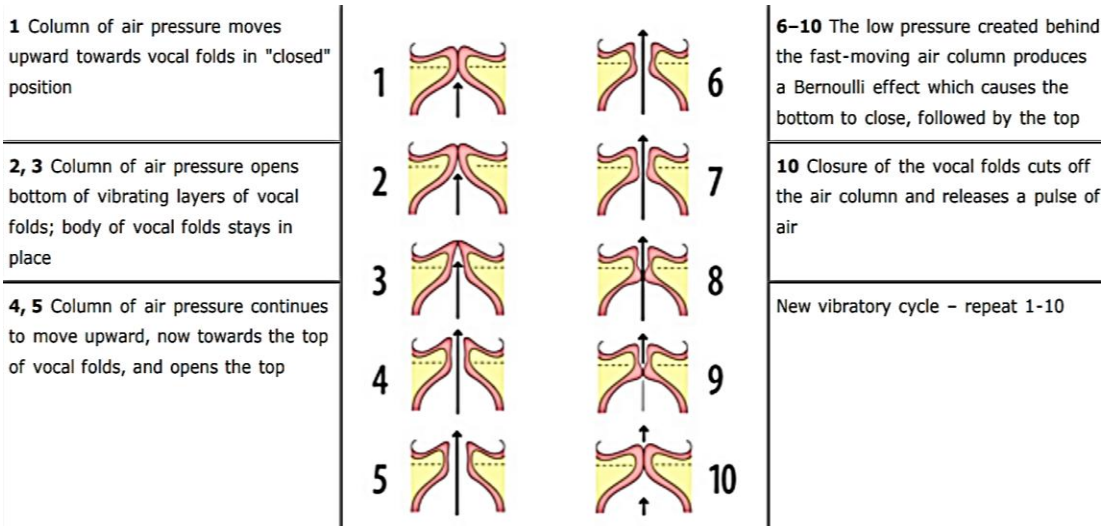
- **What are the functions of the larynx?**
  - It is involved in coughing, laughing and hiccupping.
  - It protects the airways from food entry during swallowing (via the cough reflex).
  - Breathing and control of airflow.
  - Vibration of vocal cords to produce sounds.



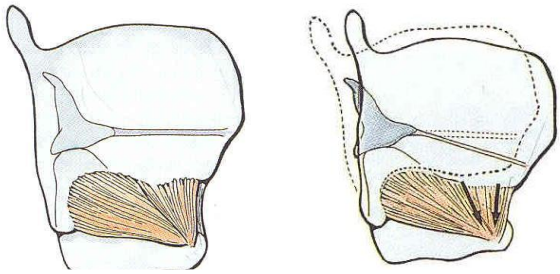


\

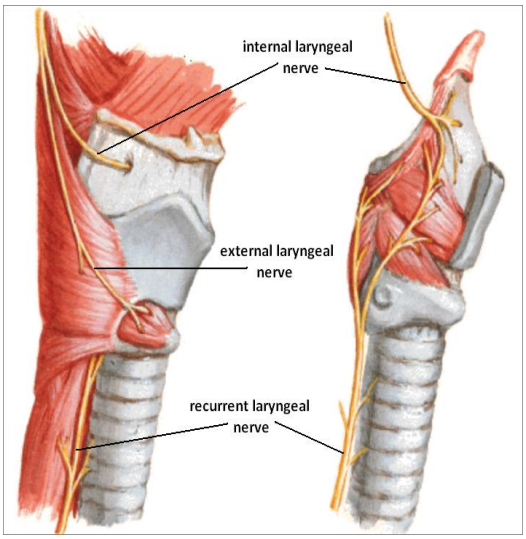
- **There are two types of movements of the vocal cords:**
  - **Abduction**: vocal cords get away from each other thus opening the glottis. This movement occurs during breathing to allow air entry and exit. Abductor of vocal cords:
    - ✓ Posterior cricoarytenoid muscle.
  - **Adduction**: vocal cords get near each other thus closing the glottis. This movement occurs during phonation to produce sounds. Adductors of vocal cords:
    - ✓ Lateral cricoarytenoid muscle.
    - ✓ Transverse arytenoid muscle.
    - ✓ Oblique arytenoids muscle.



- **To produce different frequencies and intensities of sounds, length and tension of vocal cords have to be changes. This is achieved by the following muscles:**
  - **Cricothyroid muscle**: it increases the distance between the angle of thyroid cartilage and vocal processes of arytenoids cartilages resulting in increased length and tension of vocal cords (↑pitch).



  - **Thyroarytenoid muscle (vocalis):** it pulls arytenoids cartilage forward towards thyroid cartilage thus shortens and relaxes the vocal cords (↓pitch).



- **Innervation of muscles of the larynx:**
  - All muscles of vocal cords are supplied by recurrent laryngeal nerve except cricothyroid muscle which is supplied by external laryngeal nerve.
  - **Injury to one recurrent laryngeal nerve produces**: hoarseness of voice.
  - **Injury to both recurrent laryngeal nerves (right and left) results in**: aphonia and airway obstruction (serious condition which is managed in acute setting by tracheostomy).