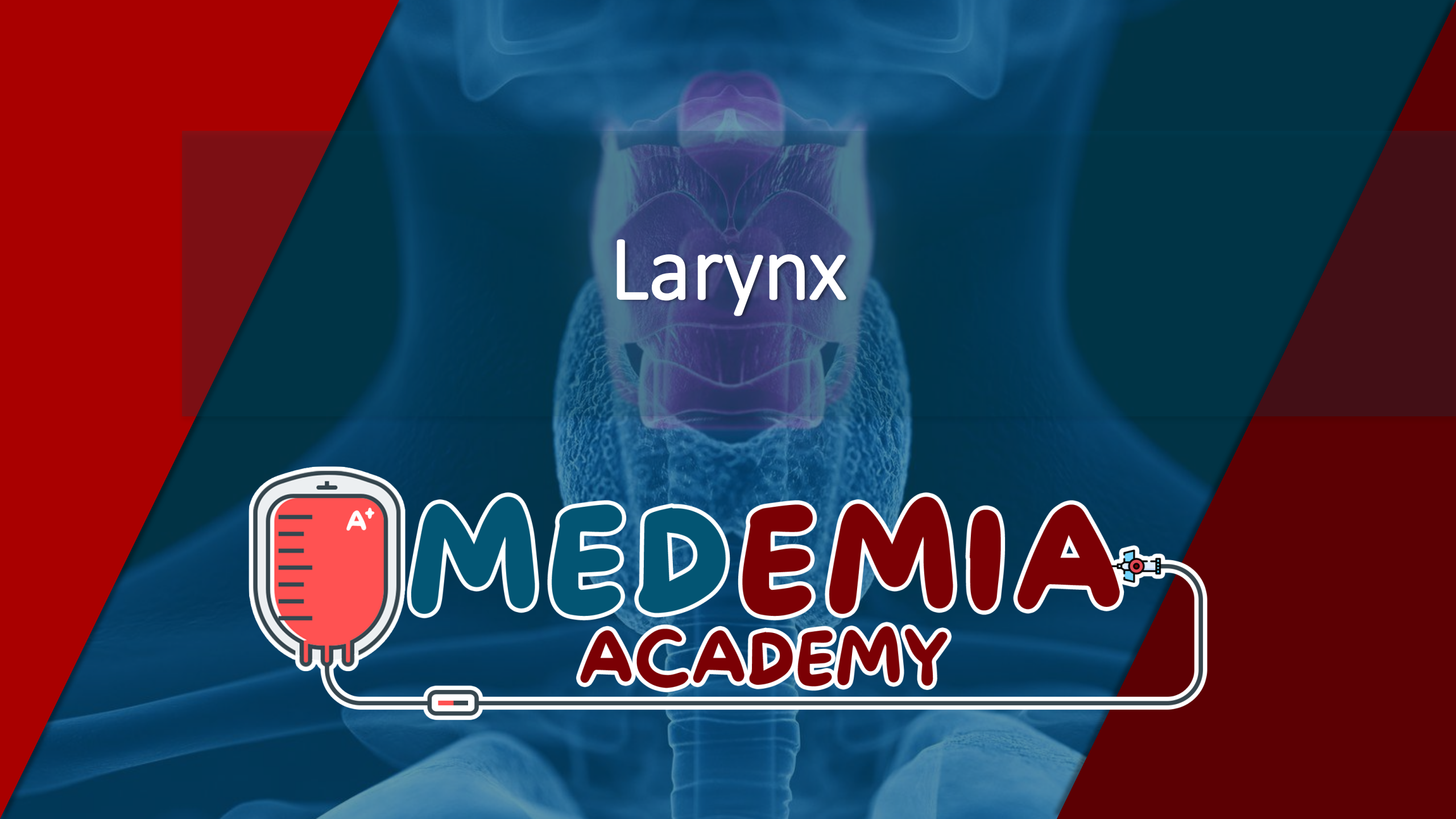
Larynx



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Intended Learning Outcomes

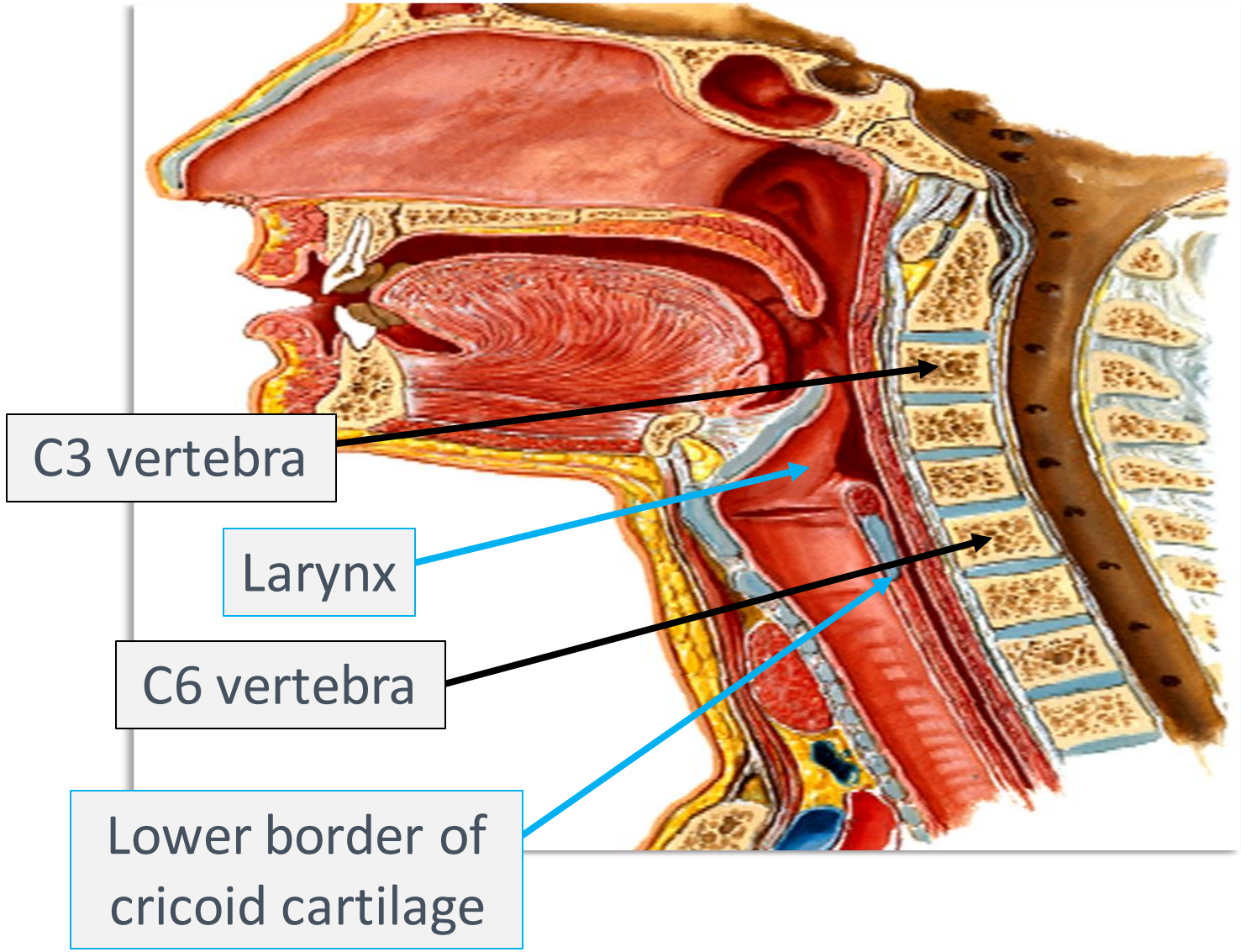
- Cartilages of the larynx
- Synovial joints of the larynx
- Membranes and ligaments of the larynx
- Cavity of the larynx
- Intrinsic muscles of the larynx
- Nerve supply of the larynx
- Clinical notes of the larynx

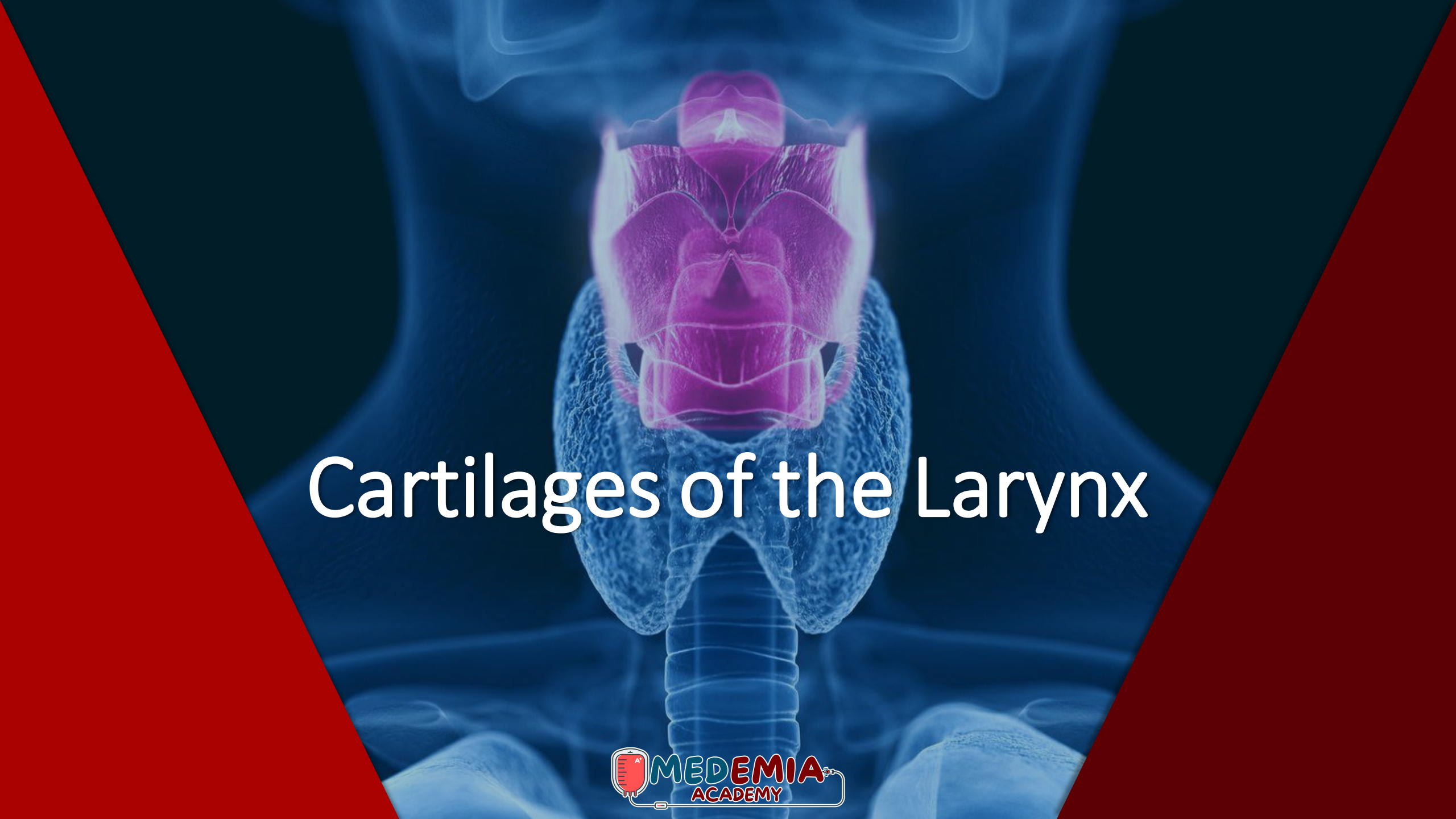
Structure of the Larynx

- The larynx is organ of voice and forms an important part of the respiratory tract.
- It is formed by number of cartilages which are articulated by synovial joints and connected together by ligaments and membranes and moved by number of muscles

Extension of the Larynx

- Extending from the root of the tongue to the trachea
  - from C3 to C6 vertebra





Cartilages of the Larynx

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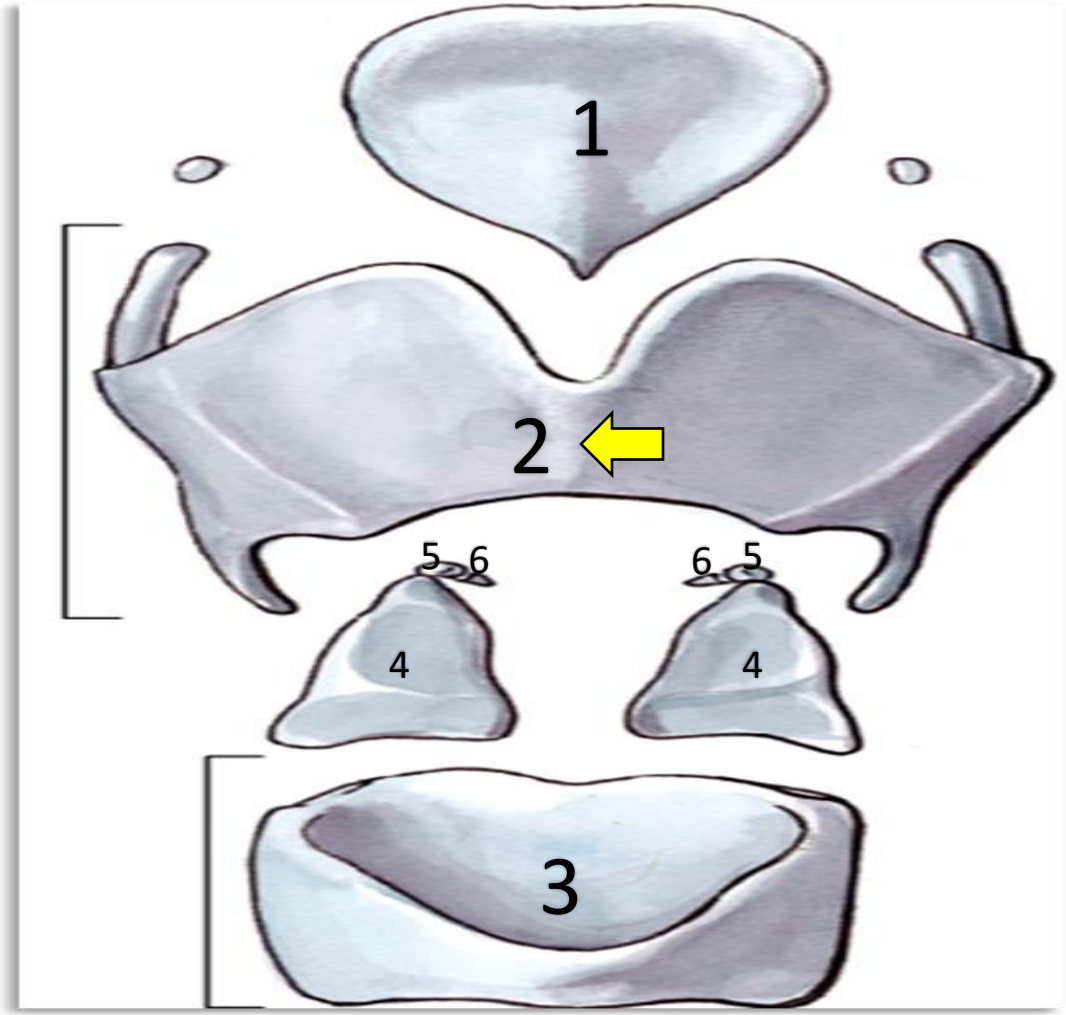
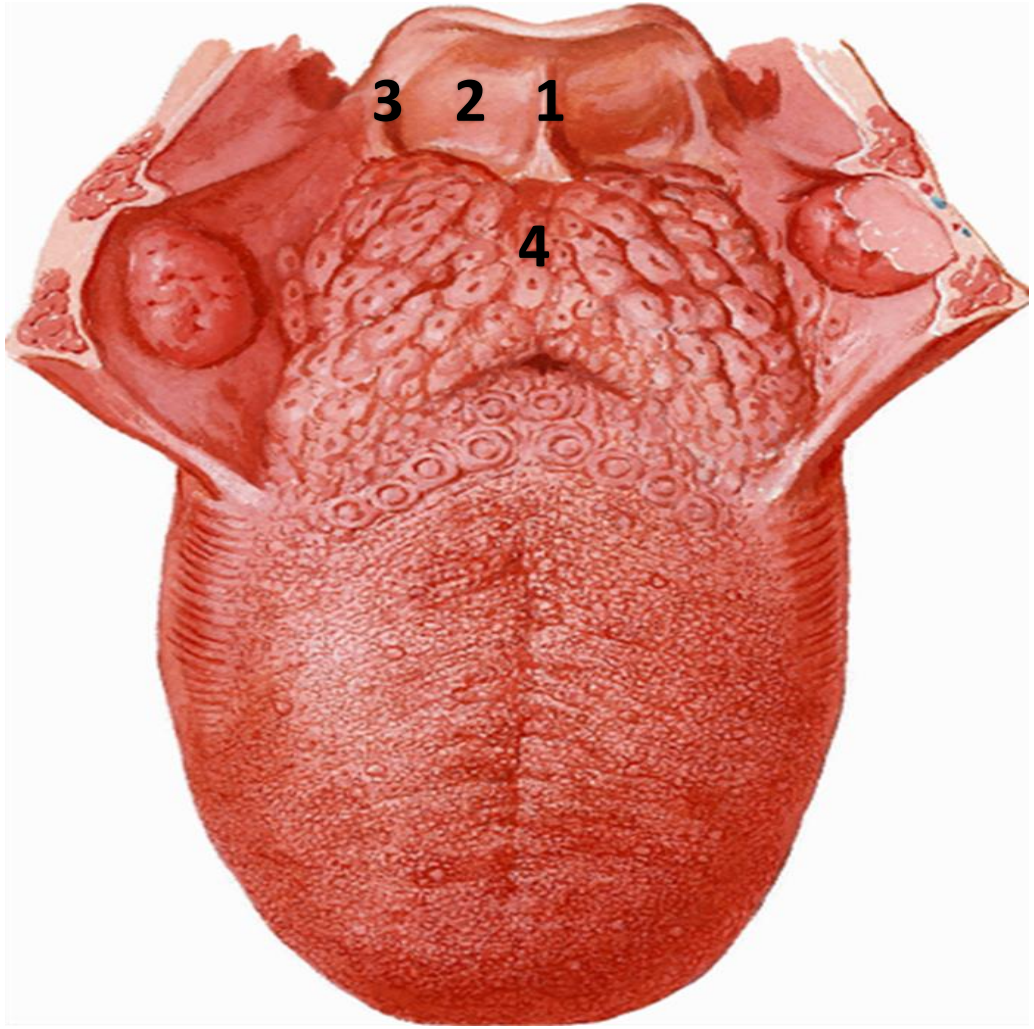
Laryngeal Cartilages

- Single Cartilages:
  1. Epiglottis
  2. Thyroid cartilage
     - The yellow arrow indicates Adam's apple
  3. Cricoid cartilage
- Paired Cartilages:
  4. Arytenoid cartilages
  5. Corniculate cartilages
  6. Cuneiform cartilages



Anterior surface of Epiglottis

1. Median glossoepiglottic fold
2. Valleculae
3. Lateral glossoepiglottic fold
4. Root of the tongue

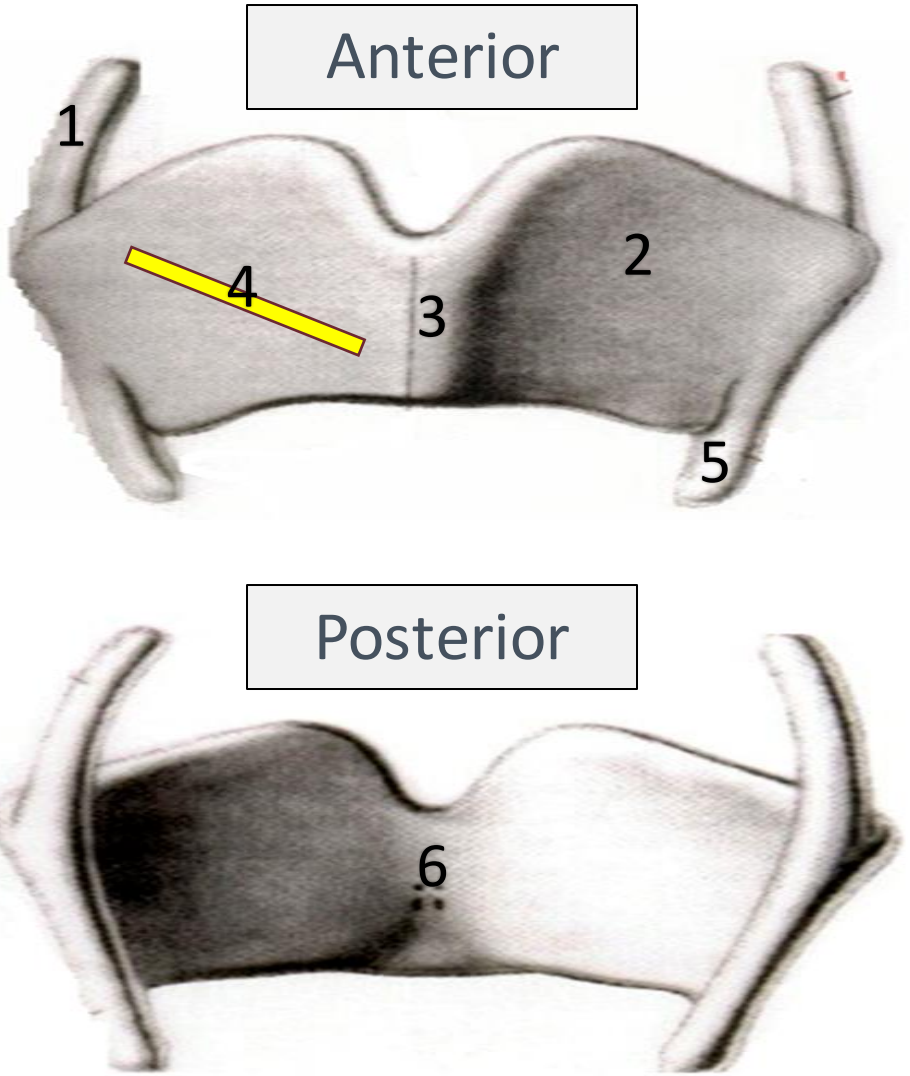


Epiglottis

- It is a leaf-like lamella of elastic cartilage.
- It projects upwards behind the tongue.
- Its upper end is wide and free.
- Its lower end is narrow and fixed to the inner aspect of the thyroid prominence.
- Posterior surface of the epiglottis is smooth
- Anterior surface is connected to the root of the tongue by:
  - A median fold called median glossoepiglottic fold.
  - On each side by a lateral glossoepiglottic folds.
  - The depression between median and lateral folds is called vallecula, It is an important landmark during oral intubation of the trachea, hold small pools of saliva to prevent initiation of the swallowing reflex.

Thyroid Cartilage

1. Superior horn
2. Thyroid lamina
3. Laryngeal prominence (Adam's apple)
4. Oblique line
5. Inferior horn
6. Angle

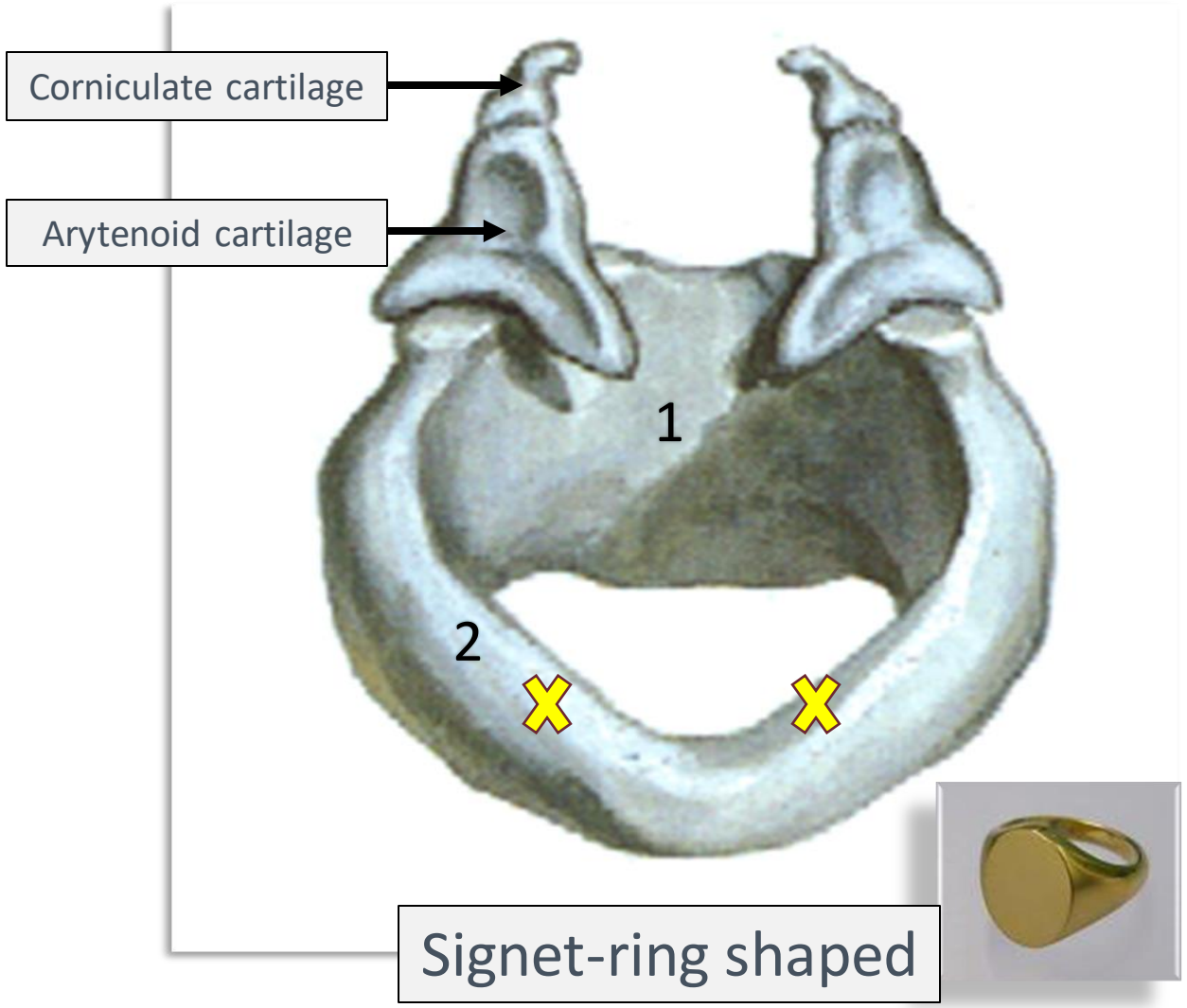


Thyroid Cartilage

- The largest one
- It is formed of 2 quadrilateral laminae which are separated posteriorly but united anteriorly to form the laryngeal prominence (Adam's apple).
- It is more prominent in in male (90 degree) than females (120 degree).
- The posterior border of each lamina has 2 horns:
  - Superior Horn: attached to the hyoid bone by the lateral thyrohyoid ligament.
  - Inferior horn: articulates with cricoid cartilage.
- The lateral surface of the lamina shows an oblique line that gives attachment to the muscles (sternothyroid, thyrohyoid and inferior constrictor muscle of the pharynx).

Cricoid Cartilage

- It's the only complete cartilaginous ring in the whole of air passage
  1. Broad posterior lamina
  2. Narrow anterior arch
     - The (x) sign indicates the articulation site with inferior horn of thyroid cartilage

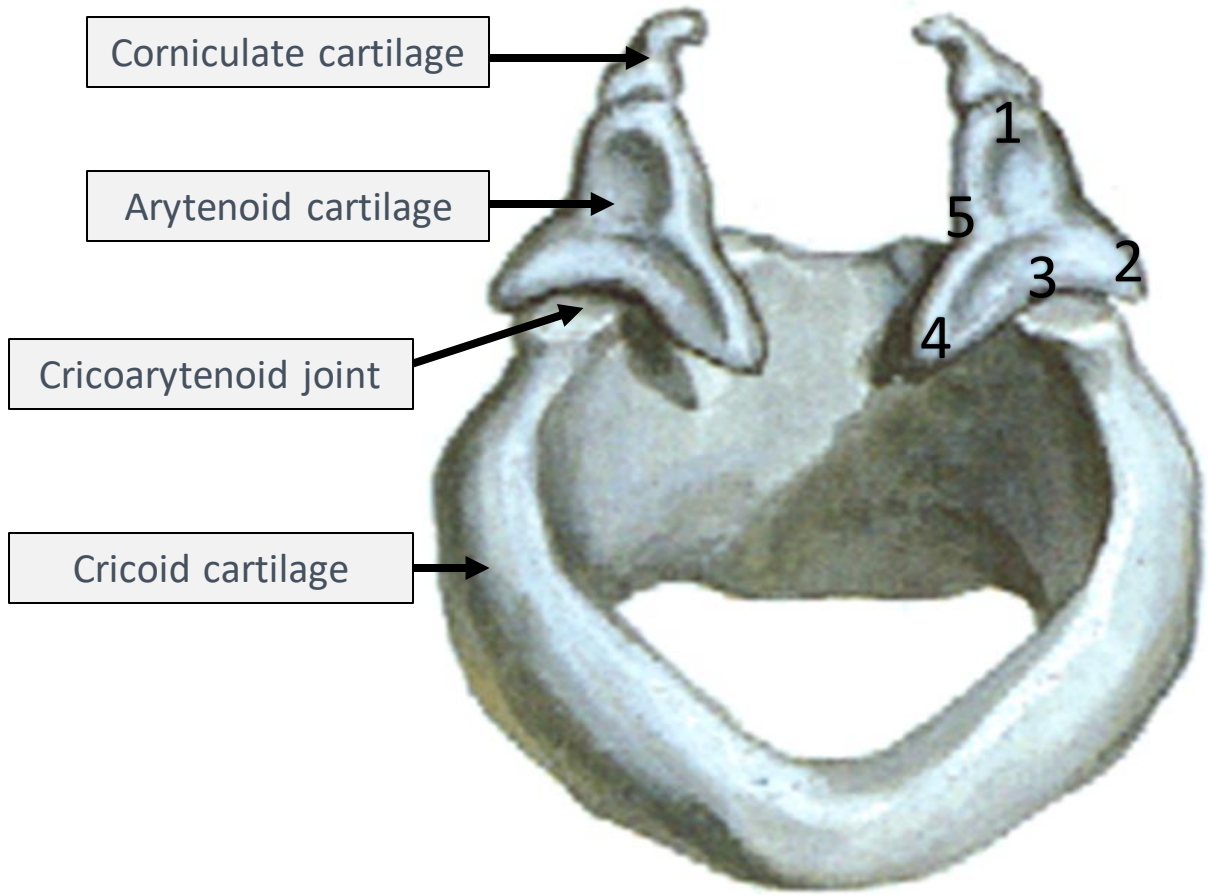


Cricoid Cartilage

- It is ring-shaped having a broad lamina posteriorly and a narrow arch anteriorly.
- It lies opposite the 6th cervical vertebrae.
- It articulates with:
  - **Posteriorly**: upper border of the lamina articulates with 2 arytenoids cartilages (cricoarytenoid joint).
  - The **anterolateral** aspect of the arch articulates with the inferior horn of the thyroid cartilage (cricothyroid joint).

Arytenoid Cartilages

1. Apex
2. Muscular process
3. Base
4. Vocal process
5. Medial surface



Pyramidal in shape

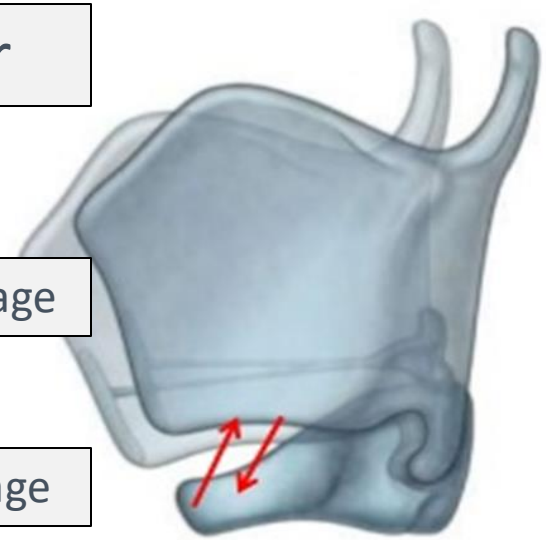
Paired Cartilages

- Arytenoid cartilages (key cartilage of the larynx)
  - Apex (above): articulates with corniculate cartilage.
  - Base (below): articulates with cricoid cartilage
    - Two processes project from the base
      - Vocal process direct gives attachment to the vocal fold.
      - Muscular process gives attachment for the muscles.
- Corniculate cartilages
  - Each one lying at the apex of the arytenoid cartilage.
- Cuneiform cartilages
  - Small cartilage nodule lying in aryepiglottic fold.

Synovial joints of the Larynx

Crico-thyroid Joint

Anterior



Thyroid cartilage

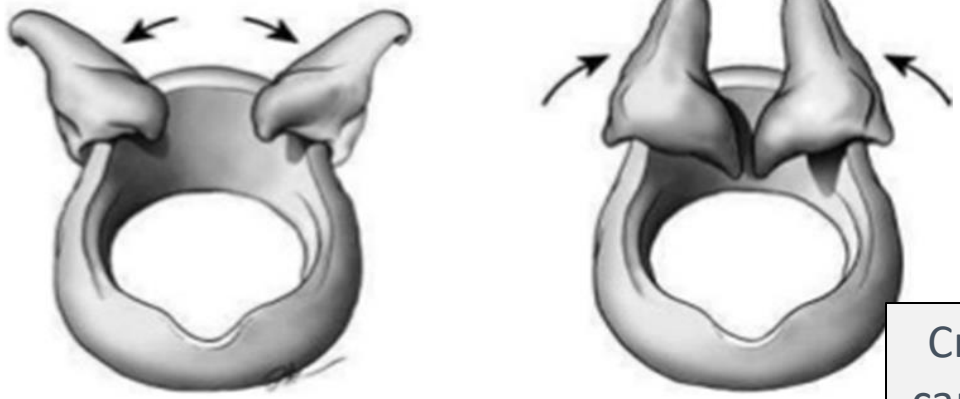
Cricoid cartilage

Forward and backward of thyroid cartilage

Crico-arytenoid Joint

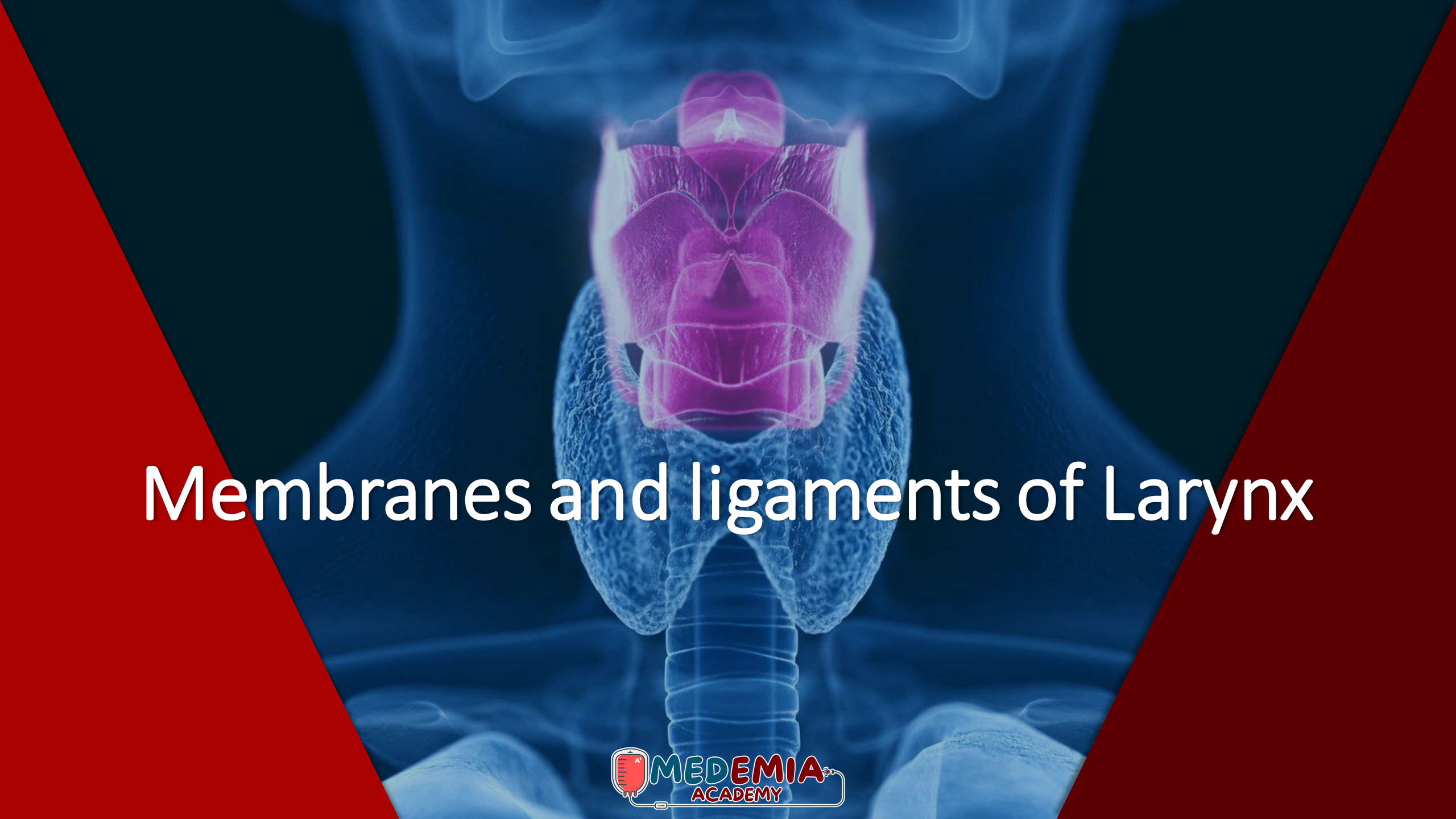
Arytenoid cartilage

Posterior



Cricoid cartilage

Abduction and adduction of the vocal cords



Membranes and ligaments of Larynx

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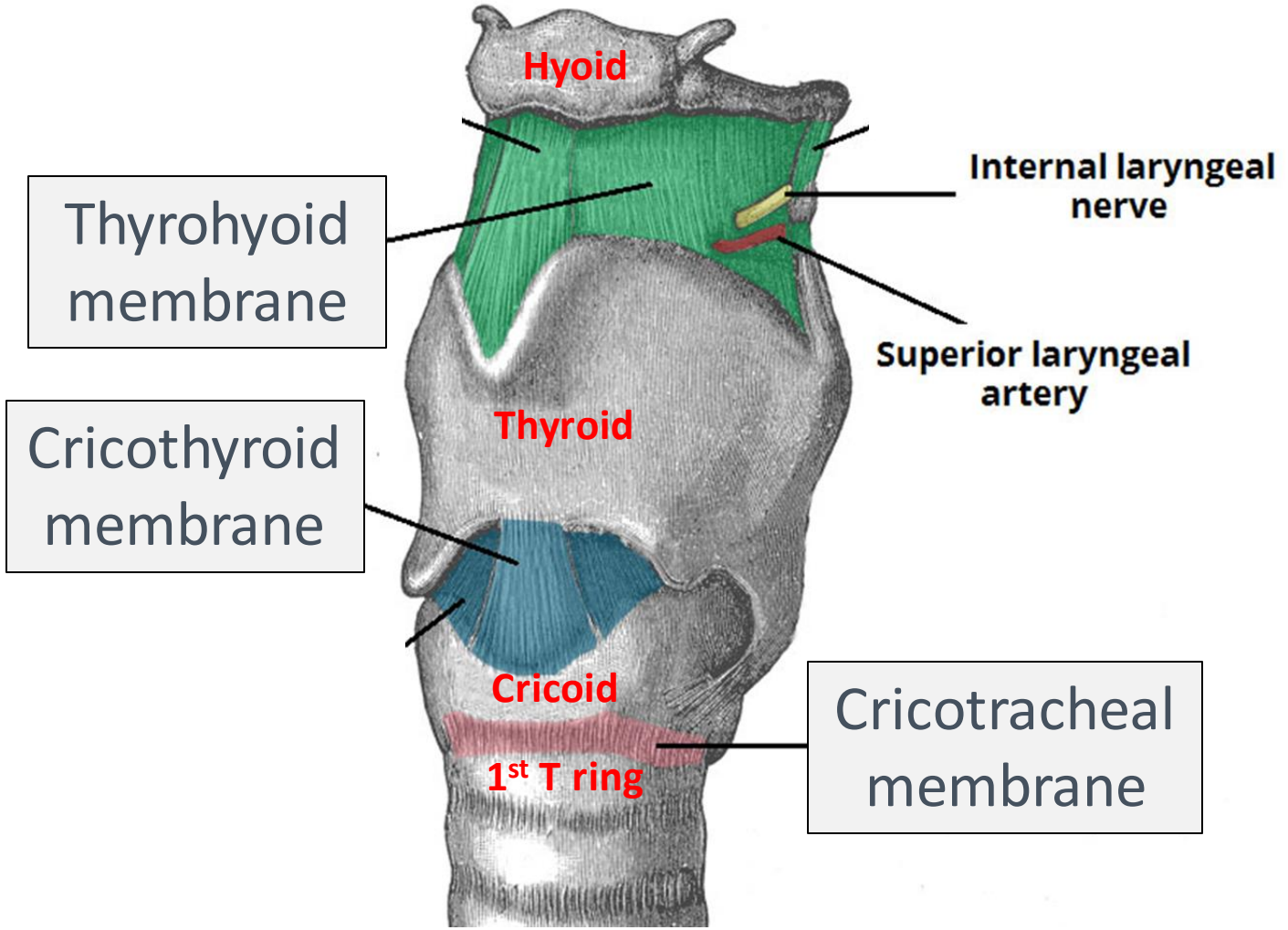
Membranes and ligaments of Larynx

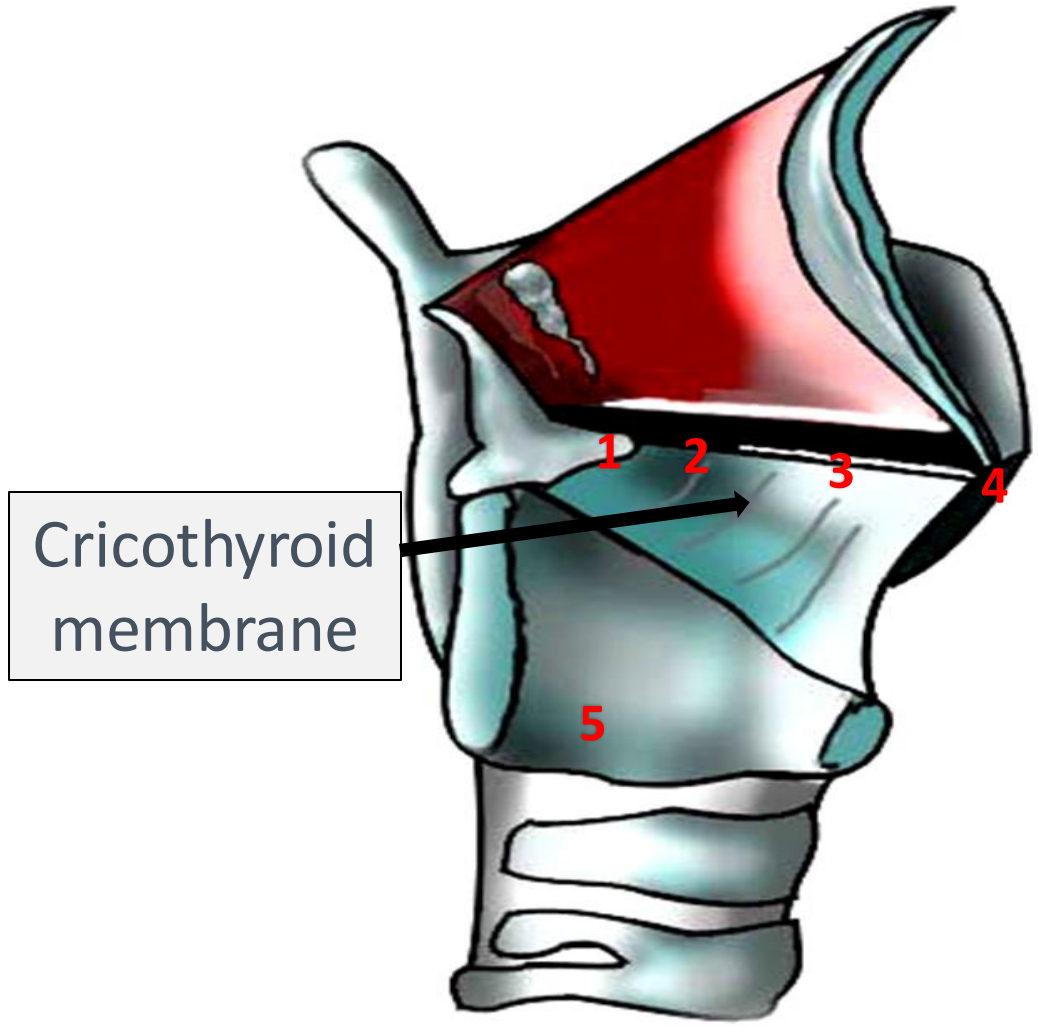


Membranes and ligaments of Larynx

- Thyrohyoid membrane:
  - Attachment
    - From the upper border of the thyroid cartilage.
    - To the hyoid bone.
  - The membrane pierced by:
    - Superior laryngeal vessels and internal laryngeal nerve.
- Cricotracheal membrane:
  - From the cricoid cartilage to the first ring of the trachea.

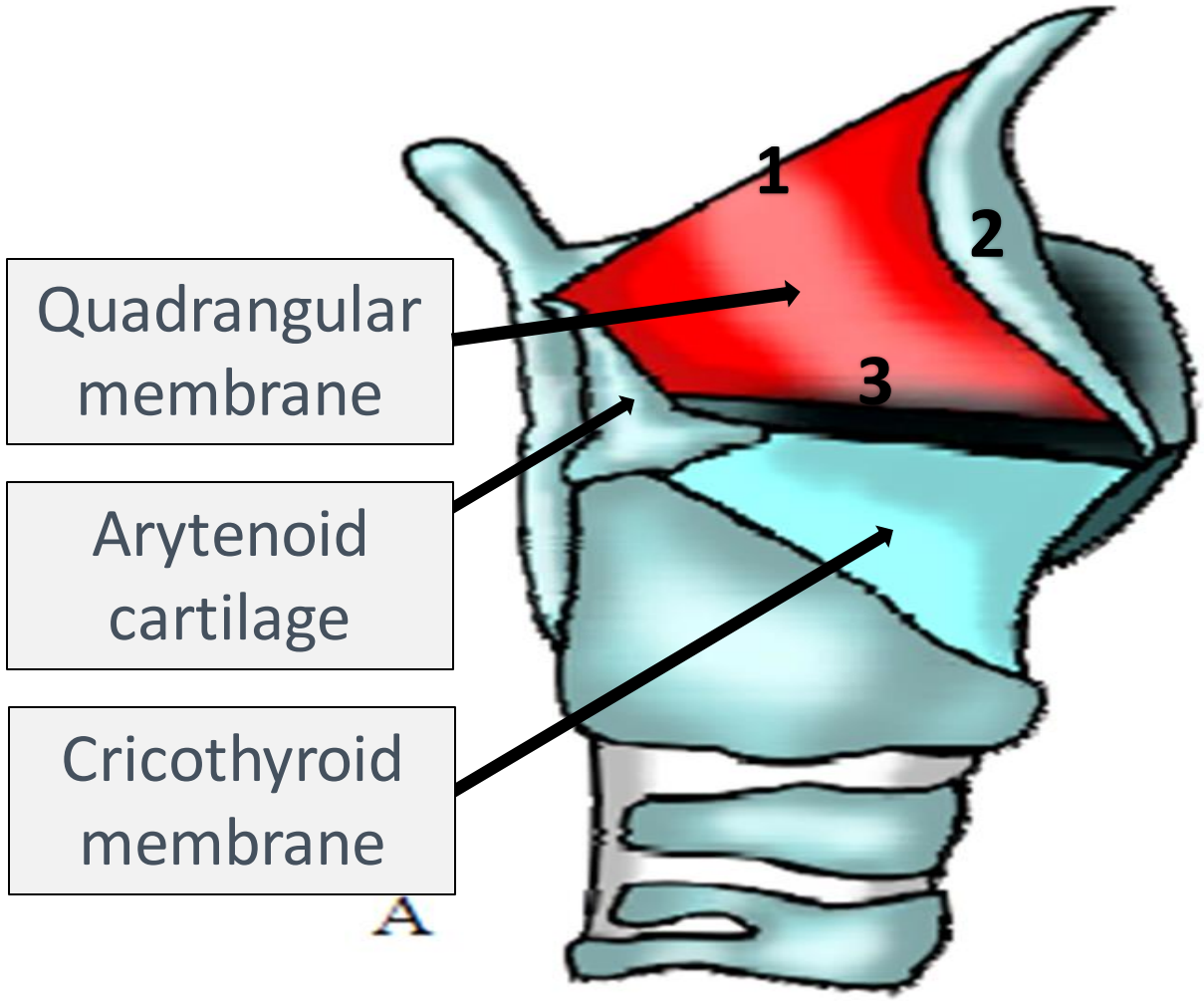
Cricothyroid membrane (Conus elasticus)

1. Vocal process of arytenoid cartilage
2. Vocal fold (true vocal cord)
3. Upper free margin
4. Thyroid angle
5. Cricoid arch



Quadrangular membrane

1. Upper free margin
   - Aryepiglottic fold
2. Epiglottis
3. Lower free margin
   - Vestibular fold (false vocal cord)



Membranes and ligaments of Larynx

- Cricothyroid membrane and ligaments (conus elasticus):
  - From upper border of cricoid cartilage to lower border of thyroid cartilage.
  - The upper free border of the lateral cricothyroid membrane (vocal fold or true vocal cord) extends between the inner surface of the angle of thyroid cartilage (anterior) and vocal process of arytenoid cartilage (posterior).
- Quadrangular membrane:
  - Extends from epiglottis (anterior) & arytenoid cartilages (posterior).
  - Upper free border (aryepiglottic fold) and forms the laryngeal inlet.
  - Lower free border forms the vestibular fold (false vocal cord).

Cavity of the Larynx

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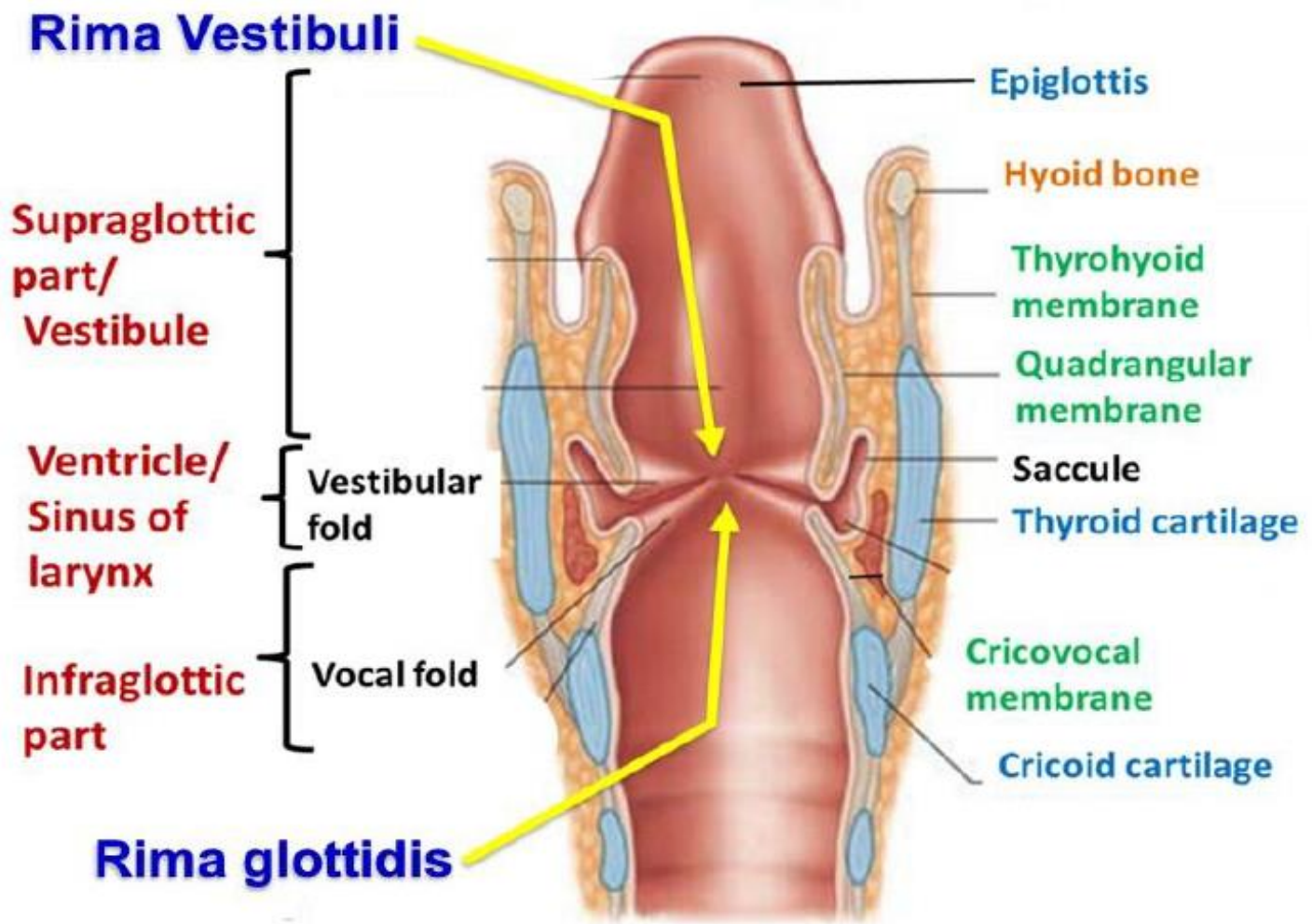
Subdivisions of laryngeal cavity

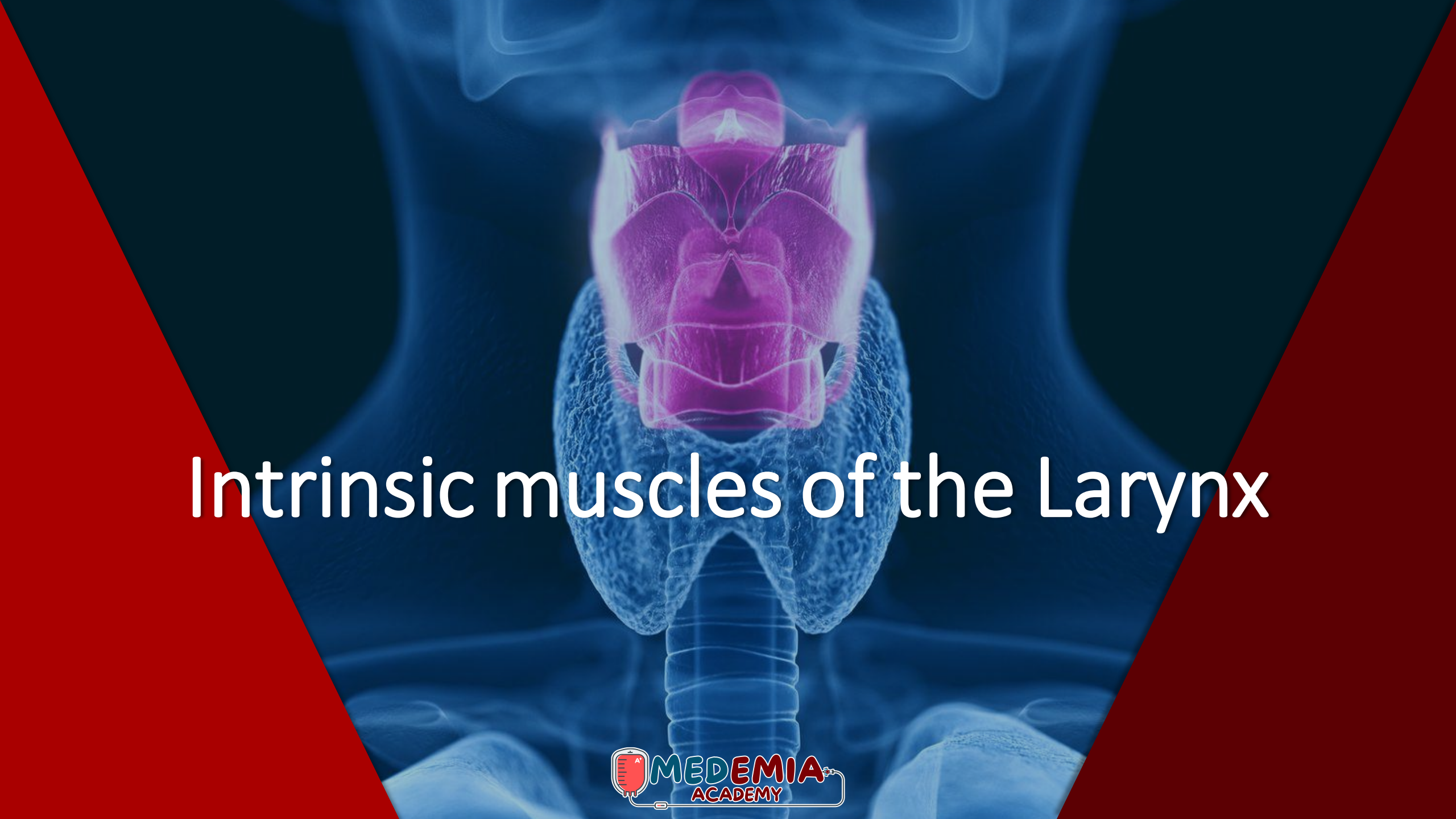


Coronal Section of Larynx

Sagittal section

Cavity of the Larynx

- Each side wall presents a pair of folds of mucous membrane.
  - Upper folds called vestibular folds (false vocal cords)
  - Lower folds called vocal folds (true vocal cords)
  - It is divided into 3 Compartments:
    - Vestibule (upper): above the vestibular folds.
    - Sinus or Ventricle (middle): between them.
      - Saccules, one on each side, a pouch extends up from the anterior part of the sinus, between vestibular fold and thyroid cartilage
    - Infraglottic part (lower): below the vocal folds.
  - Rima vestibuli: is the space between the 2 vestibular folds.
  - Rima glottidis: is the space between the 2 vocal folds.
    - It is the narrowest part of the laryngeal cavity.
    - It is more wide in male (about 23 mm) than female (17 mm).



Intrinsic muscles of the Larynx

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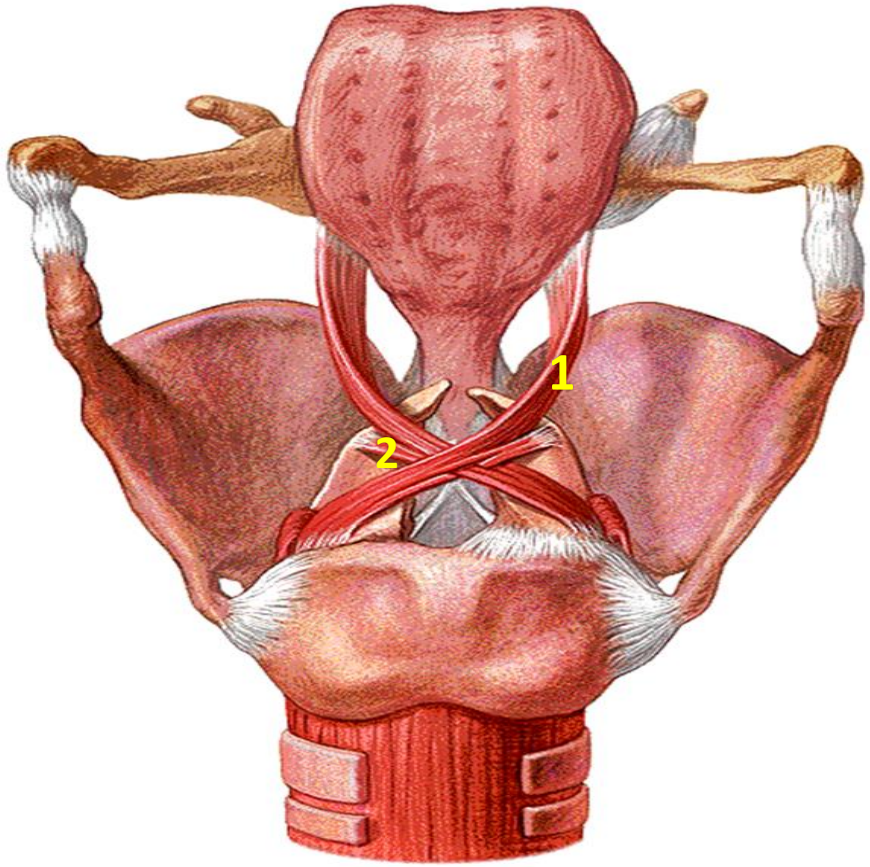
Muscles control the inlet of Larynx

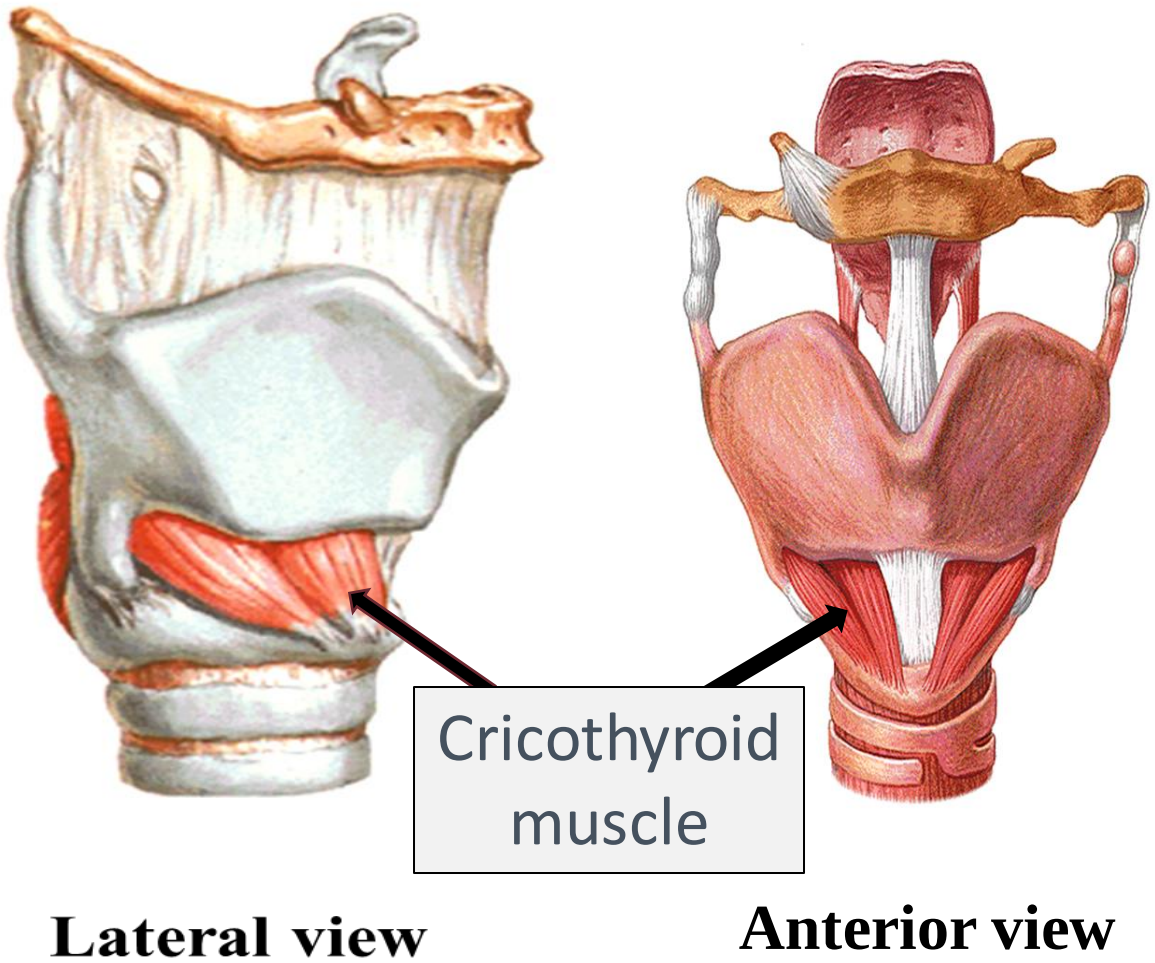
❖Muscles that act as sphincter of the inlet:

1. **Aryepiglottic muscle**
   - From arytenoid cartilage to epiglottis
2. **Oblique arytenoid muscle**
   - From muscular process of one arytenoid cartilage to apex of the opposite one



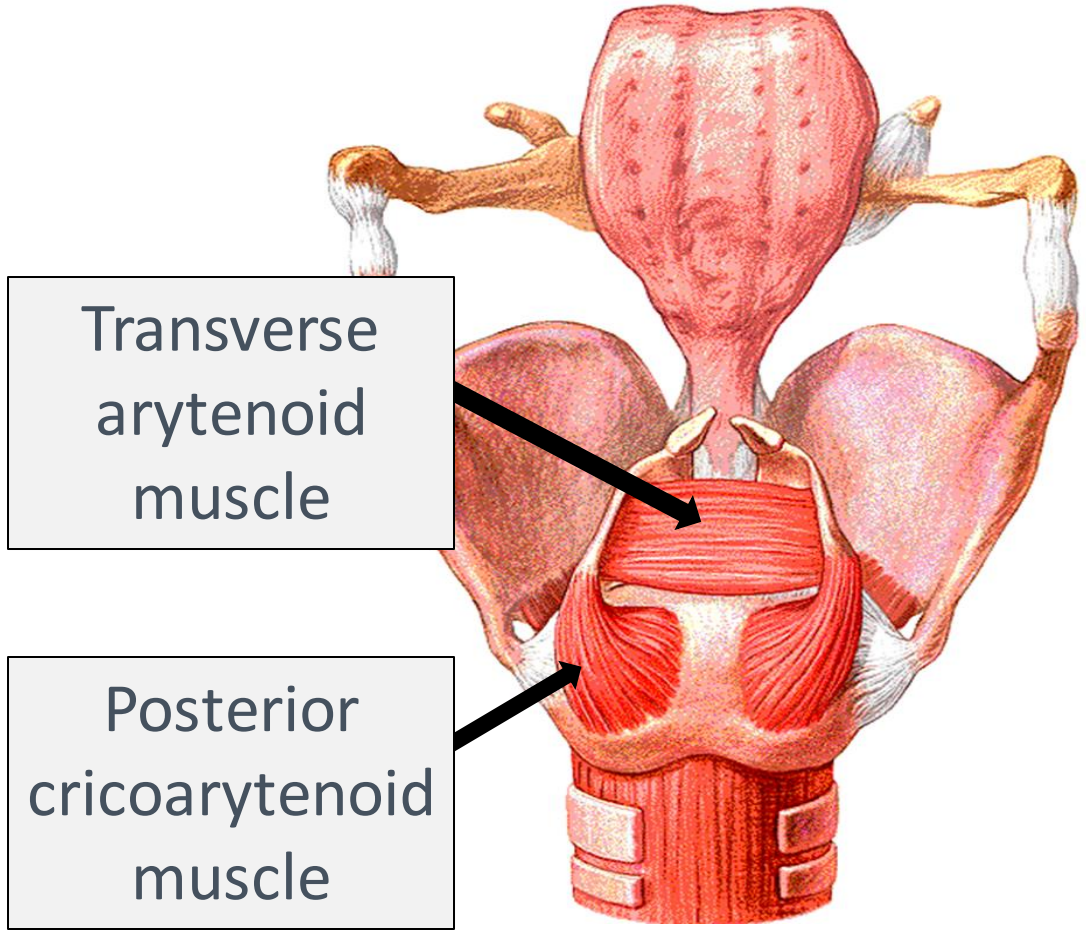
Muscles that stretch and relax the vocal cords

- **Cricothyroid muscle**
  - Stretch the vocal cords
  - From the arch of cricoid cartilage to the inferior horn and lamina of the thyroid cartilage
  - The only muscle lies outside
  - The only muscle innervated by external laryngeal nerve
- **Thyroarytenoid muscles**
  - Relax vocal cords
  - From back of thyroid angle to arytenoids cartilage.



Muscles abduct and adduct the vocal cords

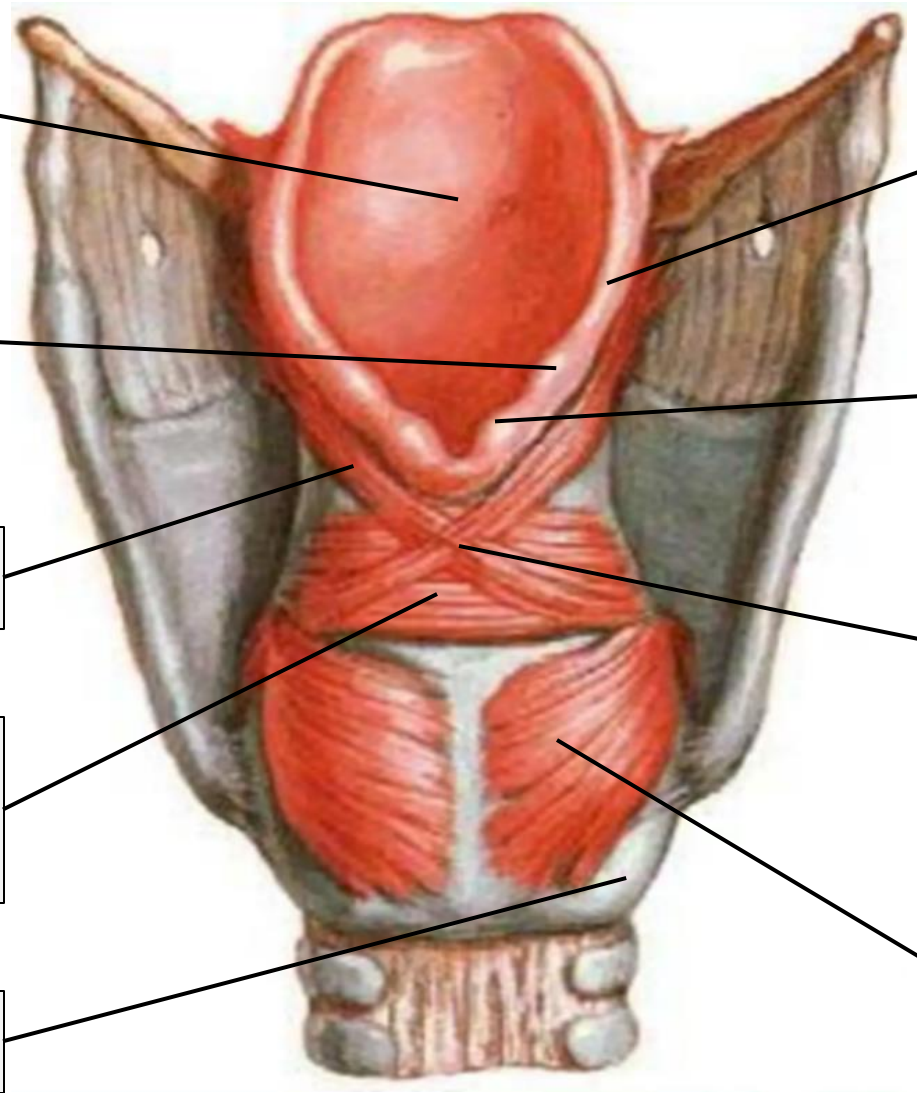
- Adduction:
  - **Transverse arytenoid muscle** (the only single one)
  - **Lateral cricoarytenoid muscle**
- Abduction:
  - **Posterior cricoarytenoid muscle** (the most important muscle)



Muscles abduct and adduct the vocal cords

- Muscles which abduct the vocal cords:
  - **The posterior cricoarytenoid muscle**
    - Origin: from the posterior surface of the cricoid cartilage.
    - Insertion: into the muscular process of the arytenoid cartilage.
    - Action: It is the most important muscle in the larynx and perhaps in the whole body, since it is the only abductor of the vocal fold (open the rima glottidis).
- Muscles which adduct the vocal cords:
  - **The lateral cricoarytenoids muscle**
    - Origin: from the upper border of the arch of cricoid cartilage.
    - Insertion: into the muscular process of the arytenoid cartilage.
  - **The transverse arytenoid muscle** (only single)
    - Origin: from the posterior surface of arytenoids cartilage.
    - Insertion: into the posterior surface of arytenoids cartilage of the opposite side.

Posterior view of the laryngeal muscles



Epiglottis

Cuneiform cartilage

Aryepiglottic muscle

Transverse arytenoid muscle

Cricoid cartilage

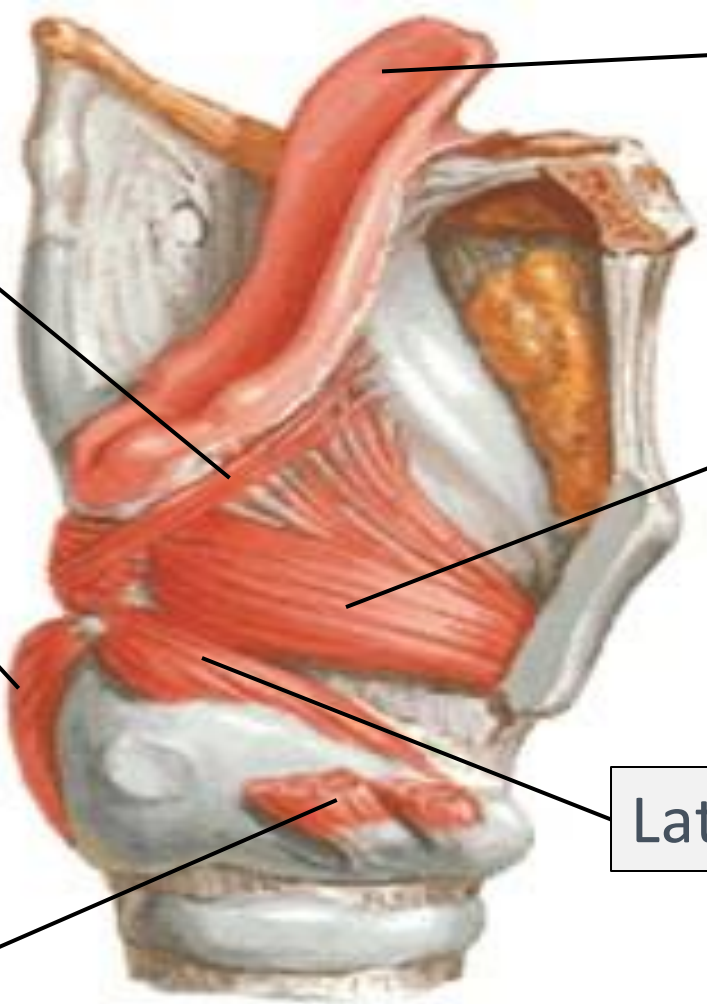
Aryepiglottic fold

Corniculate cartilage

Oblique arytenoid muscle

Posterior cricoarytenoid muscle

Lateral view of the laryngeal muscles



Epiglottis

Aryepiglottic muscle

Thyroarytenoid muscle

Posterior cricoarytenoid muscle

Lateral cricoarytenoid muscle

cricothyroid muscle

Nerve supply of the Larynx

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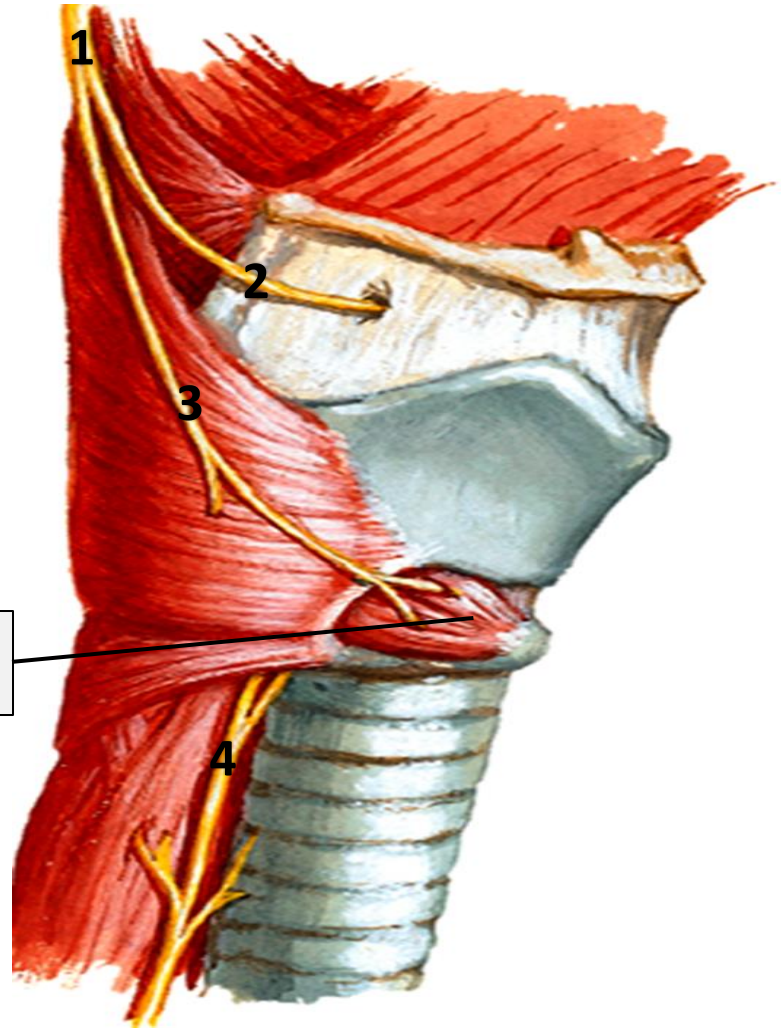
Nerve supply of the Larynx

1. Superior laryngeal nerve
   2. Internal laryngeal nerve
   3. External laryngeal nerve
4. Recurrent laryngeal nerve

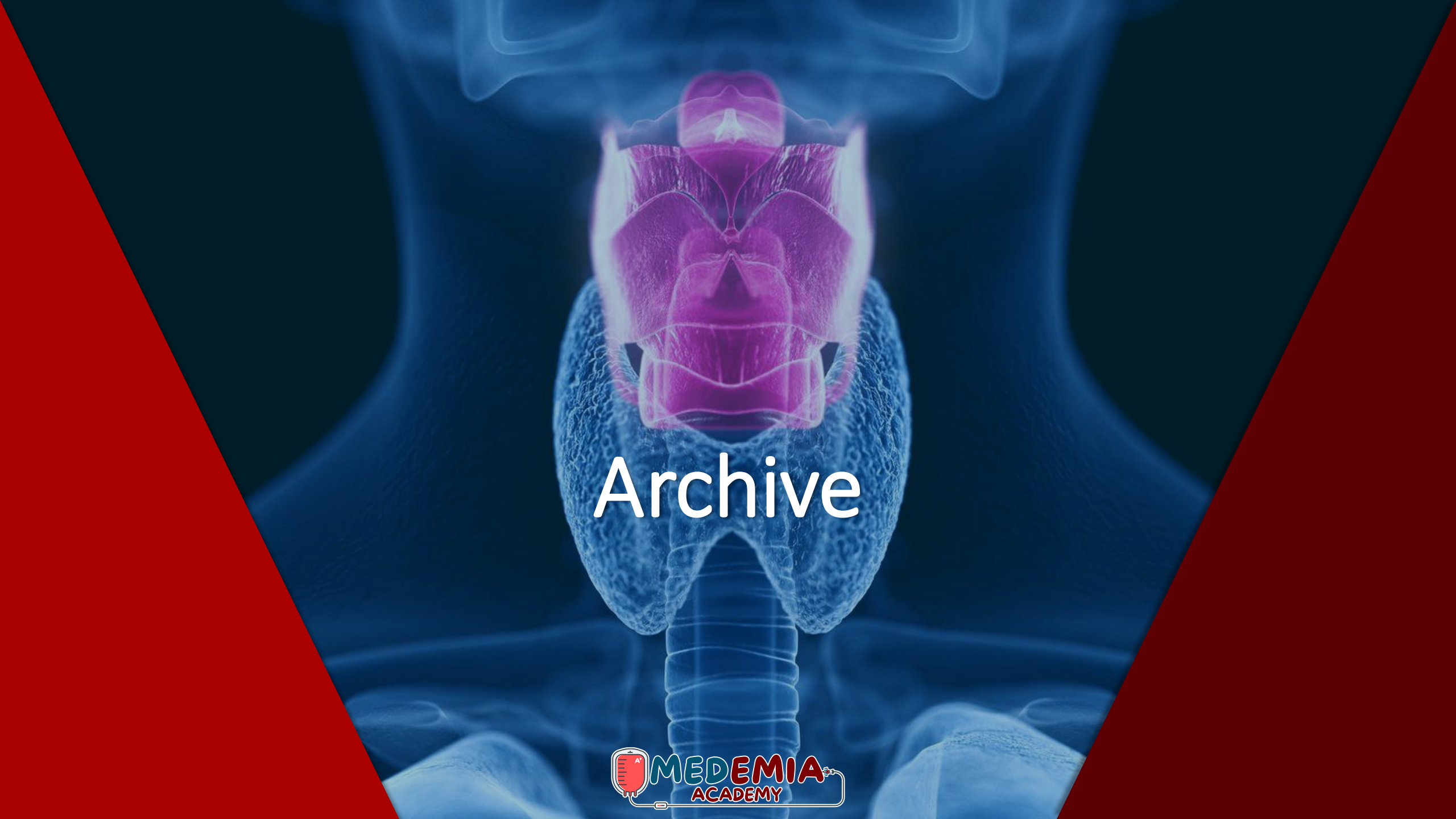


Nerve and blood supply of the Larynx

- Nerve supply
  - Motor supply
    - All the intrinsic laryngeal muscles are supplied by recurrent laryngeal nerves except cricothyroid muscle is supplied by external laryngeal nerve.
  - Sensory supply to the mucous membrane :
    - Internal laryngeal nerve above the vocal cords.
    - Recurrent laryngeal nerve below the vocal cords.
  - Left recurrent laryngeal nerve hooks around ligamentum arteriosum (longer than right)
  - Right hooks around the 1st part of subclavian artery
- Blood supply
  - Superior laryngeal artery from superior thyroid artery (ECA)
  - Inferior laryngeal artery from inferior thyroid artery (subclavian artery)

Paralysis of the laryngeal nerves

- Paralysis of the external laryngeal nerve
  - The nerve is closely related to superior thyroid artery, so it is liable to injury during thyroidectomy leading to paralysis of cricothyroid muscle (ligate artery at upper pole of the gland)
  - Unilateral injury: leading to hoarsens of voice.
  - Bilateral injury: leading to loss of voice (aphonia)
- Paralysis of the recurrent laryngeal nerve
  - The nerve is closely related to inferior thyroid artery, so it is liable to injury during thyroidectomy (ligate the artery away from the gland).
  - Unilateral Injury: vocal fold midway between abduction and adduction, speech is not greatly affected because the other fold compensates and move to the affected fold).
  - Bilateral Injury: Both folds in the midway leading to dyspnea (suffocation due to narrowing of rima glottidis), stridor and snoring.



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1. **The nerve supply the larynx below vocal cords?**
   A. Superior laryngeal nerve
   B. Pharyngeal nerve
   C. Recurrent laryngeal nerve
   D. External laryngeal nerve
   E. Internal laryngeal nerve

2. **Cricothyroid muscle is supplied by the?**
   A. Superior laryngeal nerve
   B. Pharyngeal nerve
   C. Recurrent laryngeal nerve
   D. External laryngeal nerve
   E. Internal laryngeal nerve

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3. The vocal folds extend from?

A. Vocal process of the cricoid cartilage and thyroid cartilage
B. Muscular process of the arytenoid cartilage and thyroid cartilage
C. The epiglottis cartilage and arytenoid cartilage
D. Vocal process of the arytenoid cartilage and thyroid cartilage
E. Muscular process of the cricoid cartilage and thyroid cartilage

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4. **A 25 years old man reports to ENT praxis with hoarseness of voice. Indirect laryngoscopy revealed that he is unable to widen his rima glottidis. The muscle most likely to be paralyzed is?**
   A. Vocalis
   B. Thyroarytenoid
   C. Oblique Arytenoid
   D. Posterior cricoarytenoid
   E. Cricothyroid

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5. **The thyrohyoid membrane is pierced by?**
   A. Superior thyroid artery
   B. Superior laryngeal artery
   C. Superior thyroid vein
   D. External branch of laryngeal nerve
   E. Recurrent laryngeal nerve

6. **What muscle abducts the vocal cords?**
   A. Posterior cricoarytenoid
   B. Aryepiglottic muscle
   C. Oblique arytenoid
   D. Lateral cricoarytenoid
   E. Vocalis muscle

Answers

1. C
2. D
3. D
4. D
5. B
6. A