

Reading Assignment: Chapter 5, Anatomy of Phonation (p. 161-209); supplemental reading: Chapter 3 of Dr. Hill's Lecture Notes available at my BU web site (**recommended reading online, not printing as it is long**). You may search for specific terms or topics using the Adobe Acrobat Reader search tool (binoculars).

A. Introduction

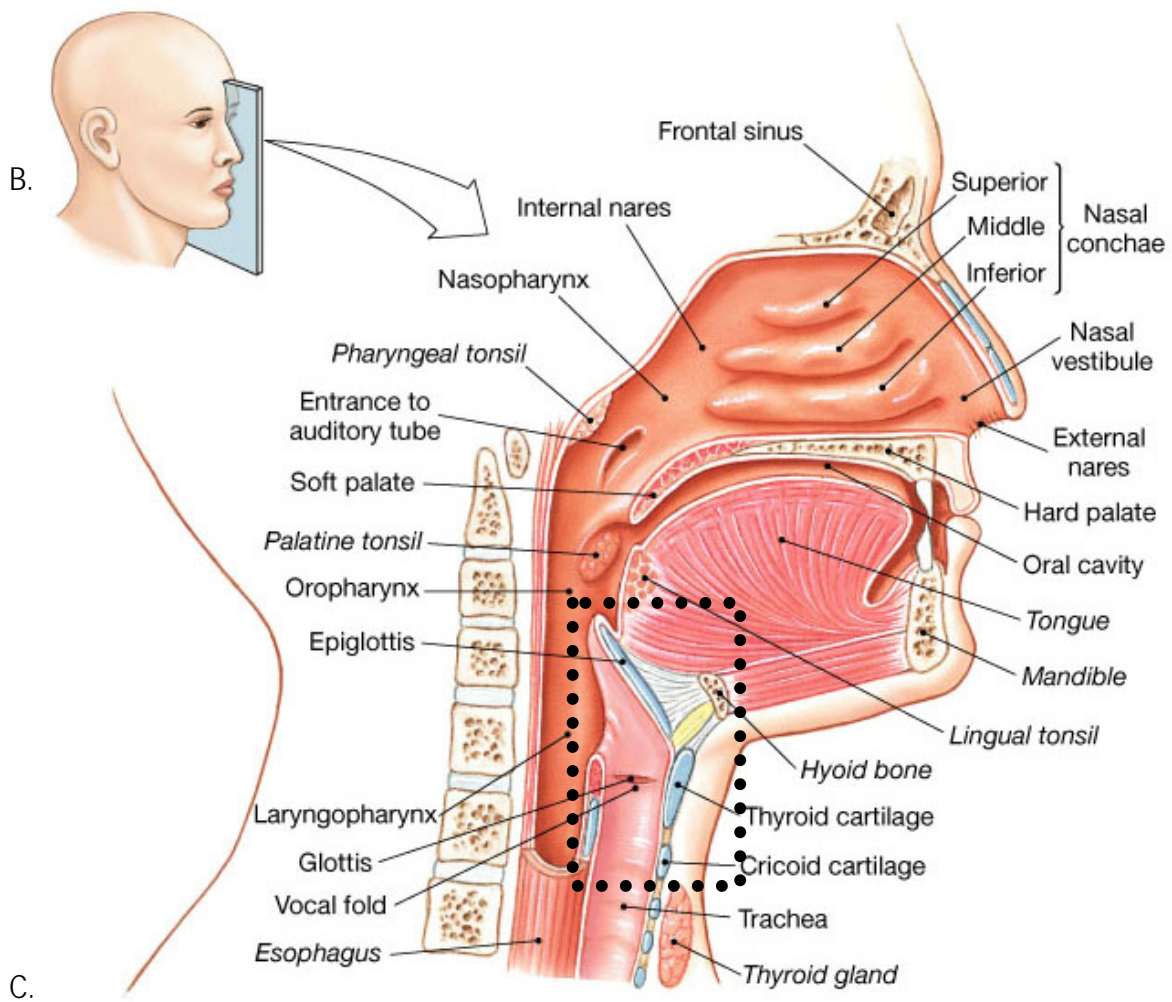
1) Phonemes –

a) voiceless –

b) voiced –

2) Biological Functions of the Larynx

B. Gross Anatomy and Location of the Larynx



C.

(c)

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C. Anatomy of the Larynx (Figure 5-2 of Seikel et al. on p. 166)

1) Folds:

a) aryepiglottic folds –

b) ventricular (false vocal) folds –

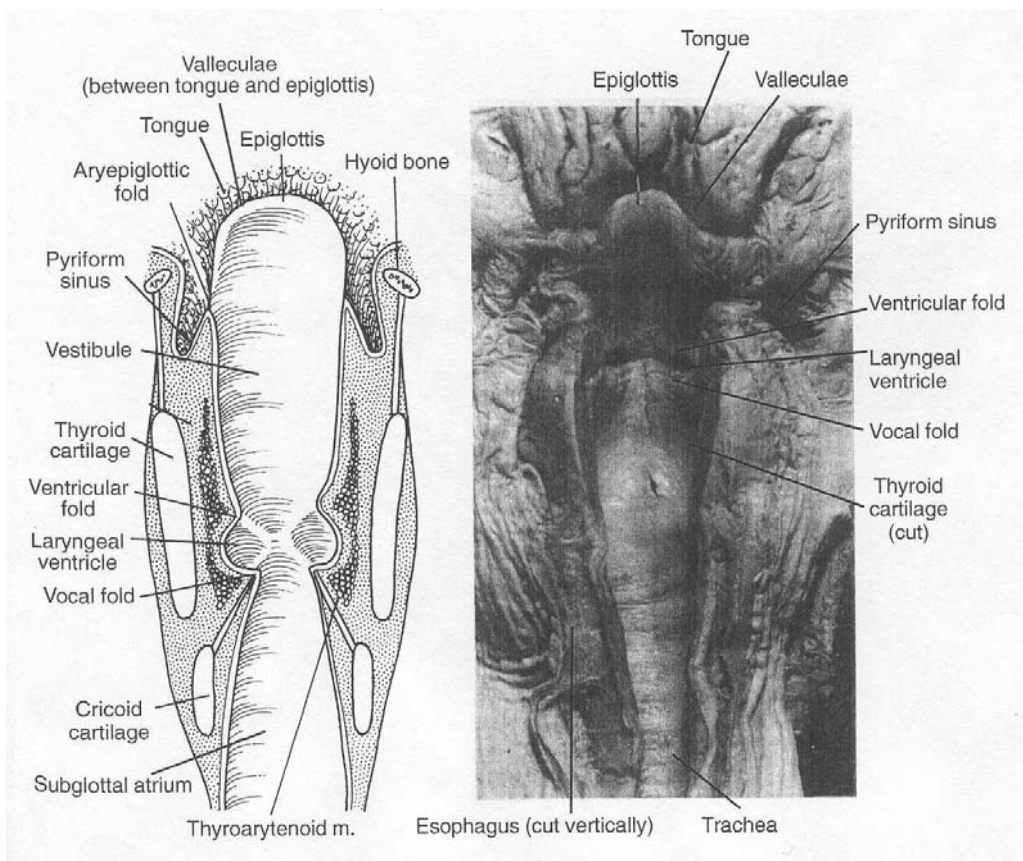
c) true vocal folds –

2) Openings or slits that mark transitions between cavities: (=constrictions between cavities)

a) aditus (*aditus laryngis*) –

b) *rima vestibule* –

c) glottis (*rima glottides*) –



3) Cavities of the larynx (=hollow chambers within the larynx)

a) vestibule –

b) ventricle (of Morgagni) –

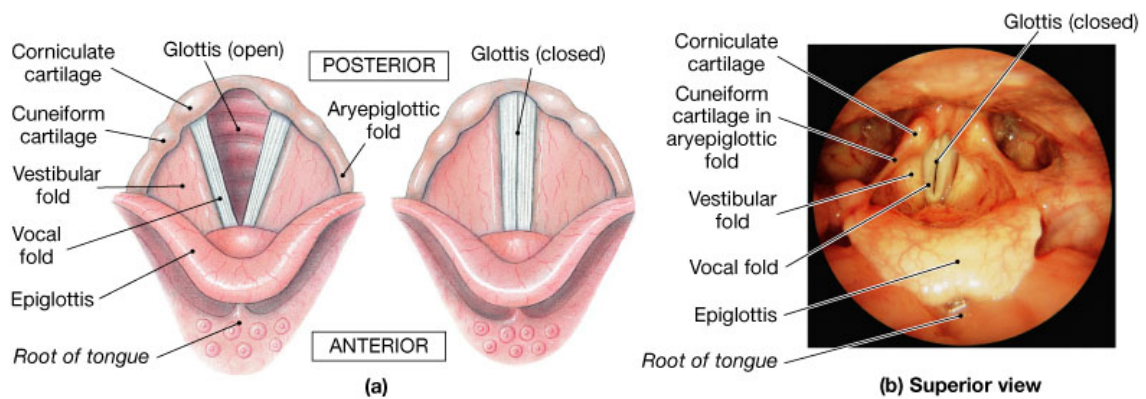
c) atrium (subglottal) –

4) Special structures occurring at the junction between the tongue, larynx, and pharynx:

a) Vallecula(e) –

b) Pyriform sinus –

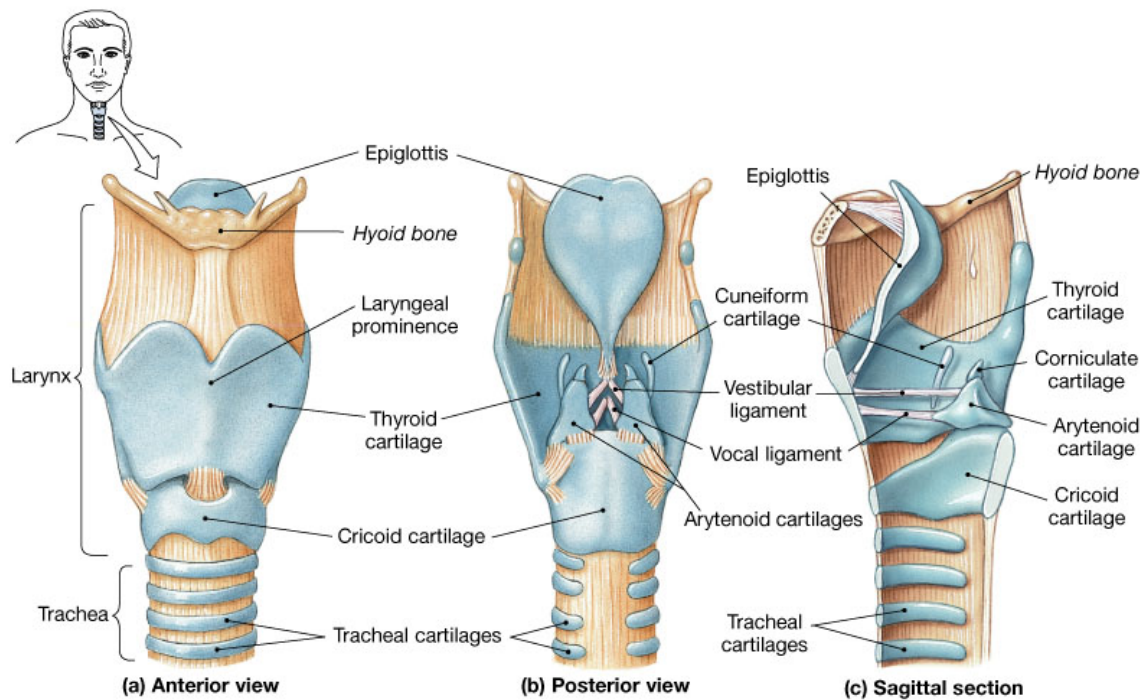
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D. Skeletal Framework of the Larynx (see also Figure 5-1 on p. 163 of Siekel et al.)

- 1) Hyoid bone
- 2) Thyroid cartilage
- 3) Cricoid cartilage
- 4) Arytenoid cartilage
 - muscular process
 - vocal process
- 5) Corniculate cartilages
- 6) Cuneiform cartilages
- 7) Triticeal cartilage
- 8) Epiglottis



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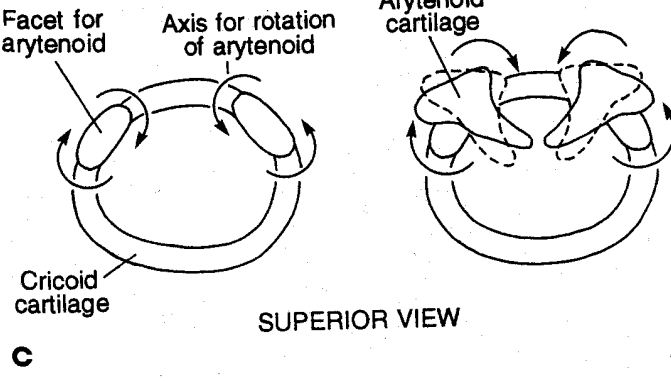
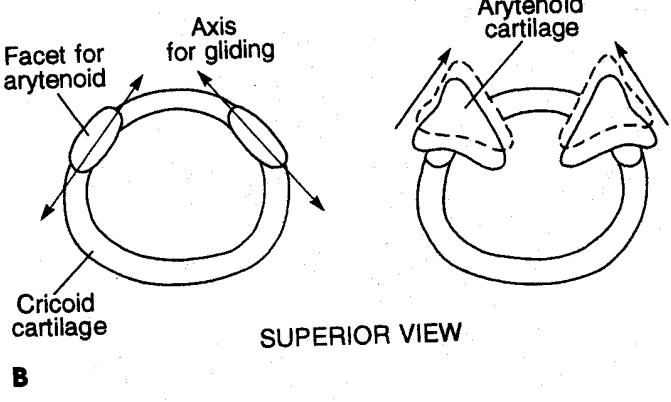
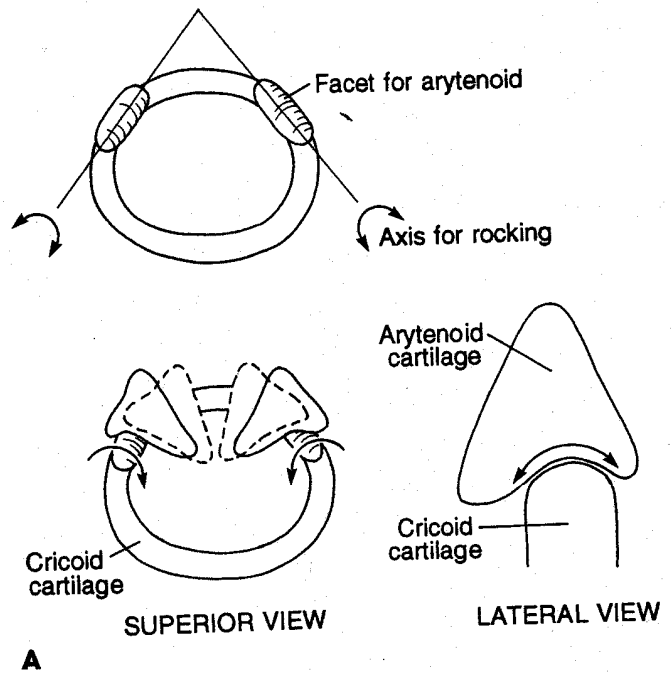
E. Histology of Laryngeal Cartilages

1) Hyaline cartilage components –

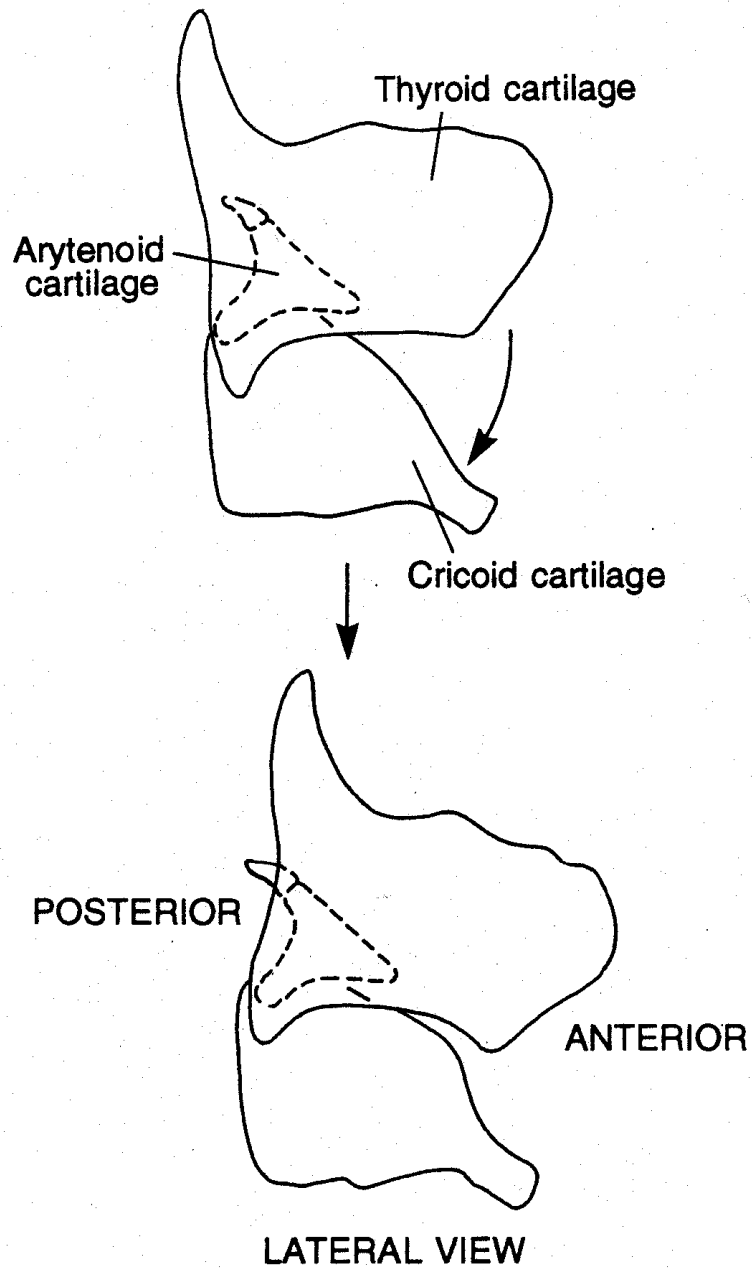
2) Elastic cartilage components –

F. Joints of the Larynx (Figures 5-10 & 5-11 of Seikel et al. on p. 181-182)

1) Cricoarytenoid joint –



2) Cricothyroid joint –



G. Laryngeal Membranes and Ligaments

1) Quadrangular membrane

2) Conus elasticus

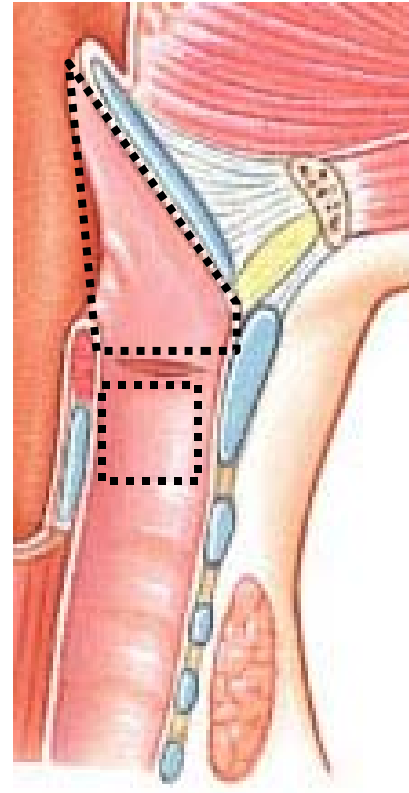
3) Extrinsic Ligaments:

- a) Glossoepiglottic ligaments (lateral and median)
- b) Cricotracheal ligament
- c) thyrohyoid membrane
- d) lateral thyrohyoid ligament with cuneiform cartilage
- e) median thyrohyoid ligament
- f) hyoepiglottic ligament
- g) thyroepiglottic ligament

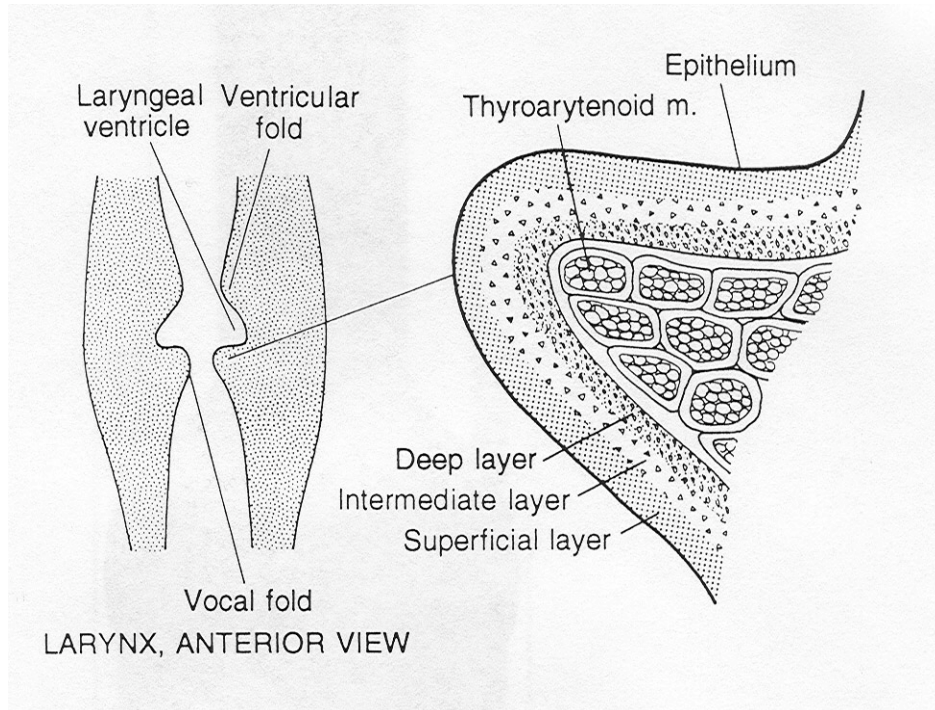
4) Intrinsic ligaments:

- a) lateral and medial cricothyroid ligaments
- b) cricoarytenoid ligaments

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H. Tissues of the Larynx Membranes (illustrated by the vocal fold)



1) Epithelium

2) Lamina propria:

a) superficial layer

b) intermediate layer

c) deep layer

3) thyroarytenoid muscle (thyrovocalis + thyromuscularis)

HOMEWORK ASSIGNMENT: Read the following clinical information boxes and answer the questions that follow.

Laryngectomy (p. 164):

Define
laryngectomy –

expectoration –

What type of special care does a laryngectomee require?

Valleculae and Swallow (p. 165):

What is the function of the valleculae and pyriform sinuses during normal swallowing?

Why do patients with compromised swallowing often have “malodorous breath?”

Vocal Fold Hydration (p. 173):

As dehydration increases, the effort required for phonation: (circle an answer below)

increases, decreases, remains the same

I. Laryngeal Muscles and How They Work

1) Two Groups of Laryngeal Muscles:

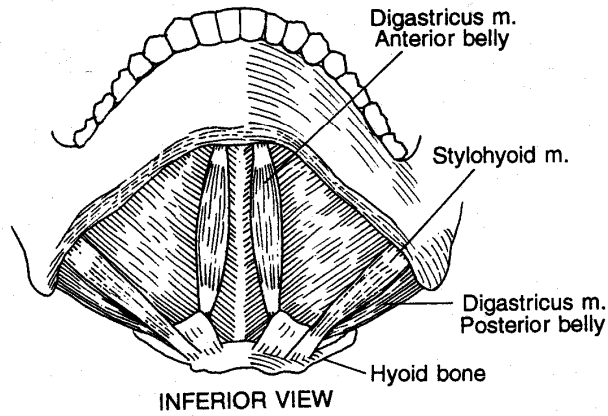
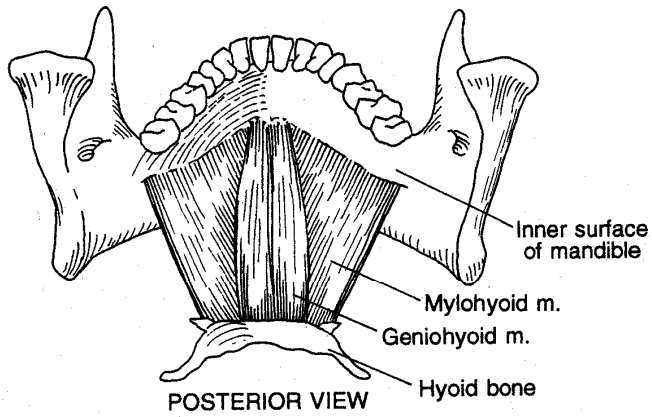
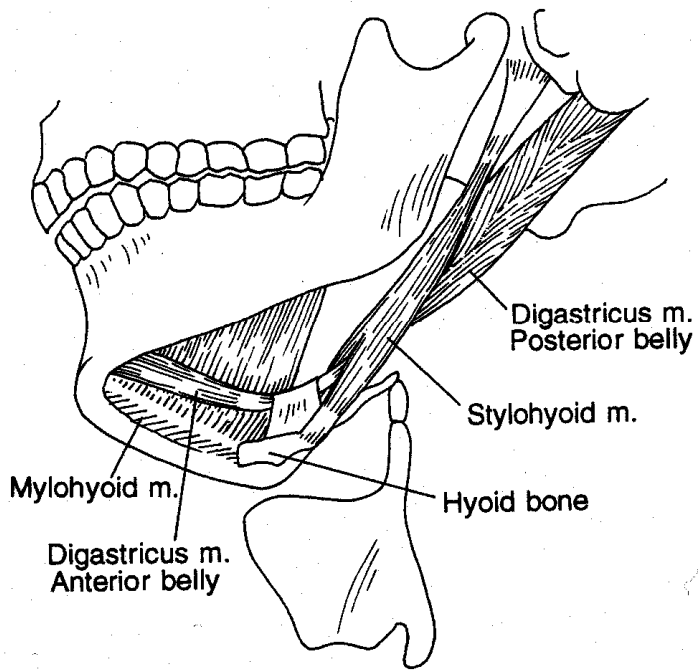
Extrinsic laryngeal muscles –

Intrinsic laryngeal muscles –

2) Extrinsic Laryngeal Muscles

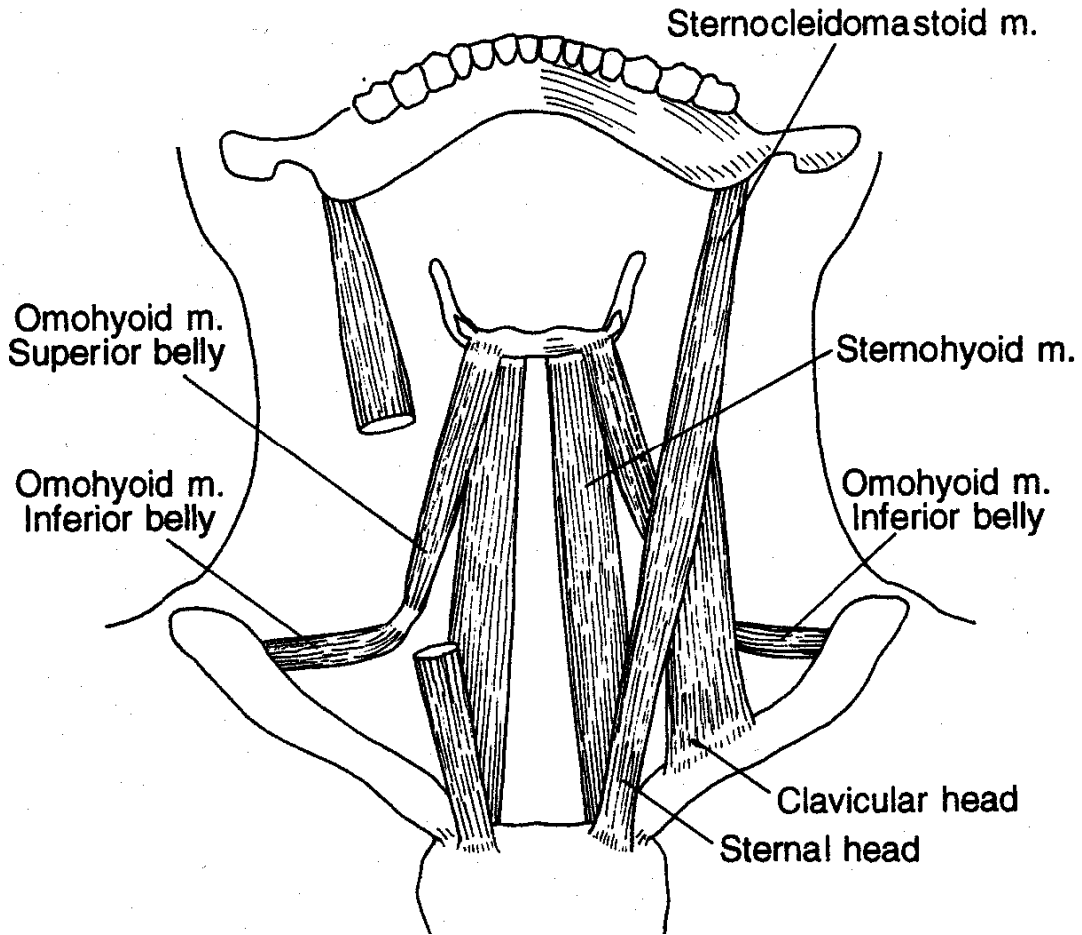
a) Suprahyoids (elevators) (Figures 5-18 & 5-19 in Siekel et al. p. 198-200) –

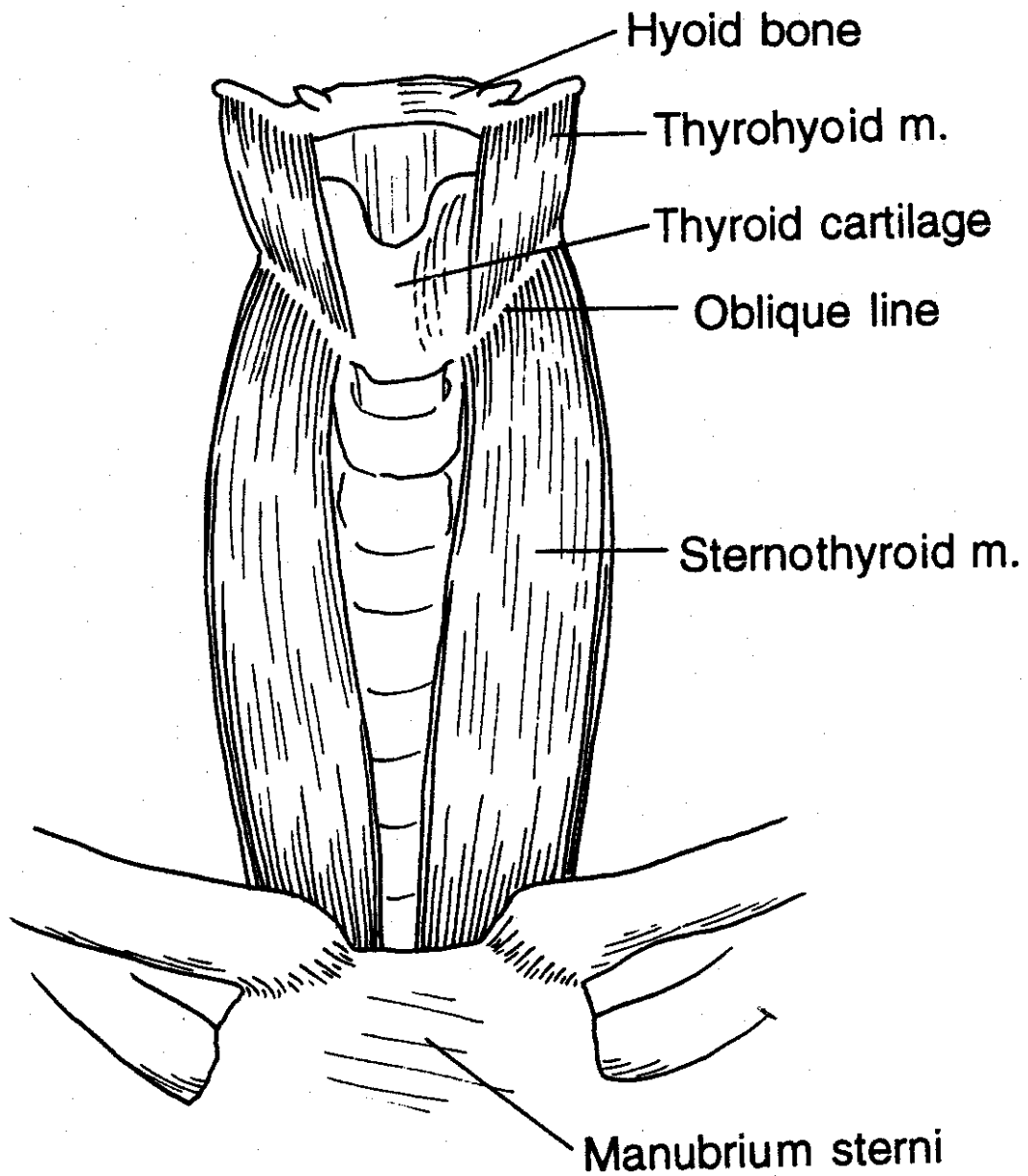
Name	Origin	Insertion	Action	Nerve
1) digastric	Mastoid, inner mandible surface	hyoid	Moves hyoid upward/forward	Cranial nerves V and VII
2) geniohyoid	Internal surface of the mandible	Anterior surface of the hyoid	Draw tongue and hyoid bone forward	Cranial nerve XII
3) stylohyoid	Styloid of temporal bone	Greater horn of the hyoid	Elevate and retract the hyoid	Cranial Nerve VII
4) mylohyoid	Mylohyoid line at mandibular symphysis	Median raphe extending from the mental symphysis to the hyoid	Elevate the hyoid/ depress the mandible	Cranial Nerve V



b) Infrahyoids (depressors) (Figures 5-20 & 5-21 in Siekel et al.) –

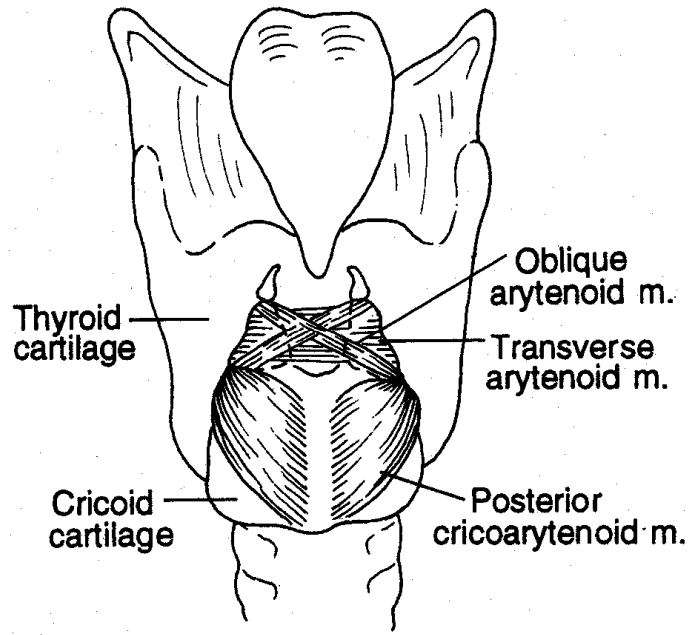
Name	Origin	Insertion	Action	Nerve
1) sternohyoid	Medial portion of the clavicle and sternum	Inferior surface of the medial portion of the hyoid bone	Depress the hyoid	Cranial Nerve XII
2) sternothyroid	Sternum and first costal cartilage	Thyroid cartilage	Depress the thyroid cartilage	Cranial Nerve XII
3) omohyoid	Superior margin of the scapula	Inferior body of hyoid bone	Depress and retract the hyoid bone	Cranial Nerve XII
4) Gravity				



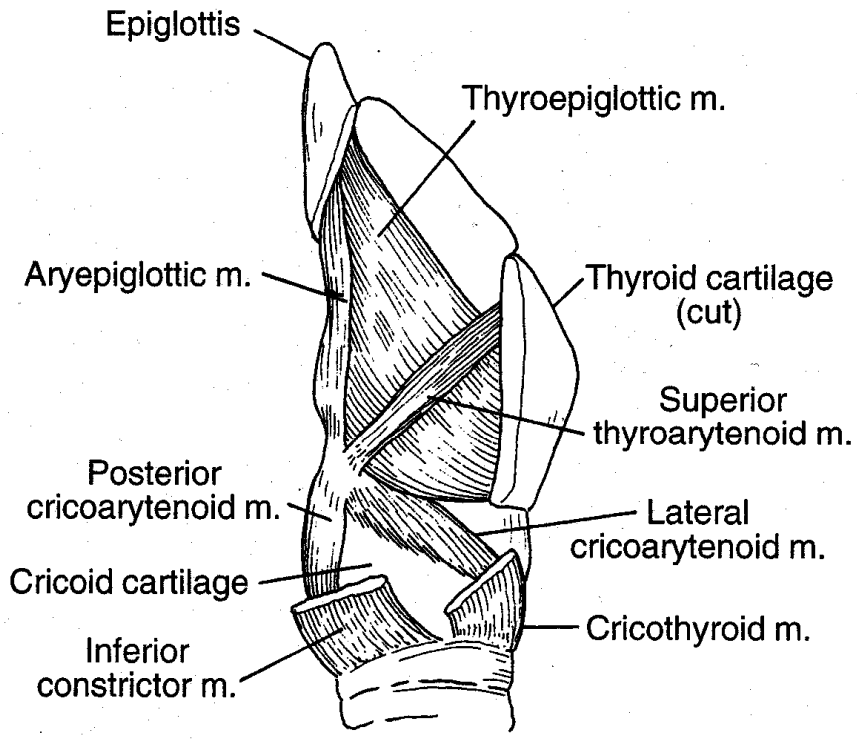


3) Intrinsic laryngeal muscles (Figure 5-12 to 5-17 in Seikel et al. on p. 192)

Name	Origin	Insertion	Action	Nerve
a) Elevator 1) Thyrohyoid –	Thyroid cartilage	Hyoid bone	Depresses hyoid or elevates thyroid (if hyoid is fixed)	Cranial Nerve XII
b) Abductor 1) Posterior cricoarytenoid –	Posterior surface of the cricoid cartilage	Muscular process of the arytenoid cartilage	Rotate vocal processes laterally	Cranial Nerve X
c) Adductors				
1) Cricothyroid –	Anterior & lateral surface of the cricoid cartilage	Caudal border of the thyroid cartilage	<u>Pars Recta</u> : draws thyroid downward <u>Pars oblique</u> : pulls thyroid forward	Cranial Nerve X
2) Interarytenoids (transverse & obliques) –	arytenoid	arytenoid	Adduct arytenoid cartilages	Cranial Nerve X
3) Lateral cricoarytenoids	Arch of the cricoid	Muscular process of the arytenoid	Rotate vocal processes toward each other (adduct vocal fold)	Cranial Nerve X
d) Tensors and Relaxers of the Vocal Fold (thyroarytenoid = thyromuscularis + thyrovocalis)				
1) Thyromuscularis –	Thyroid angle	Anterolateral surface of arytenoids	Reduce tension on vocal fold, sphincter function	Cranial nerve X
2) Thyrovocalis –	Posterior thyroid angle	Vocal process and lateral arytenoid	Increases tension on the vocal fold	Cranial Nerve X
Intrinsic tensors Thyrovocalis, cricothyroid, posterior cricoarytenoids	See above	See above	When either thyroid or arytenoids are stationary and the other (arytenoids or thyroid) moves due to these muscles, increased tension may result.	All Cranial Nerve X



A. POSTERIOR VIEW



B. LATERAL VIEW

4) Laryngeal Muscle Activities

a) breathing

b) valvular activity

c) phonation

J. Neural Supply to the Larynx

1) General Characteristics –

2) Sensory Nerves –

Vagus: Superior Laryngeal, Internal Branch: Provides touch sensation from epiglottis, posterior tongue, larynx above the vocal folds.

Vagus: Recurrent Laryngeal: innervates remaining mucous membrane of larynx.

Vagus: Various branches: Muscle proprioceptors, monitor joint capsules, baroreceptors

3) Autonomic Fibers –

Various nerves: supply fibers that control blood vessel diameter and laryngeal mucus secretions.

4) Motor Nerves –

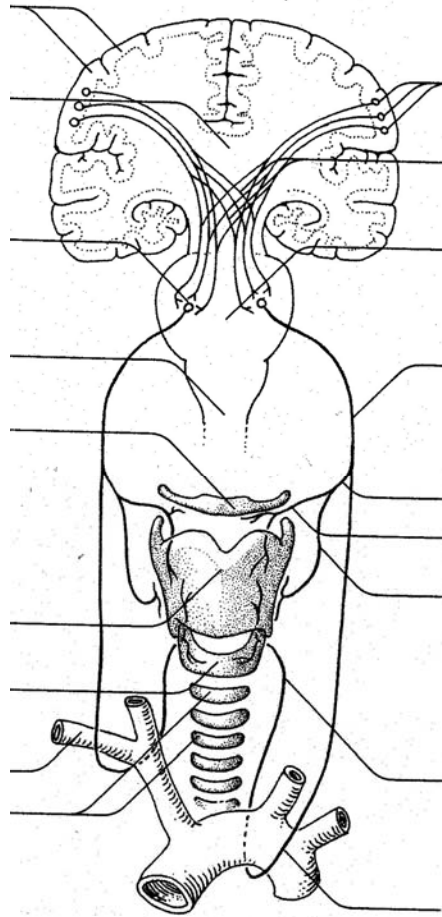
Cranial Nerves V (trigeminal), VII (facial), XII (hypoglossal) and Upper Cervical Spinal Nerves: supply extrinsic laryngeal muscles.

Cranial Nerve X: innervate all intrinsic except thyrohyoid

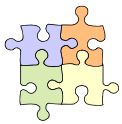
Superior Laryngeal branch of Vagus: innervates cricothyroid muscle

Recurrent Laryngeal Inferior Laryngeal branch of Vagus: innervates all other intrinsic laryngeals except the thyrohyoid

Cranial Nerve XII: innervates thyrohyoid



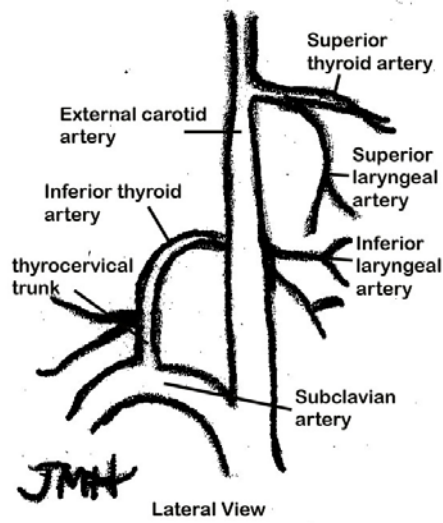
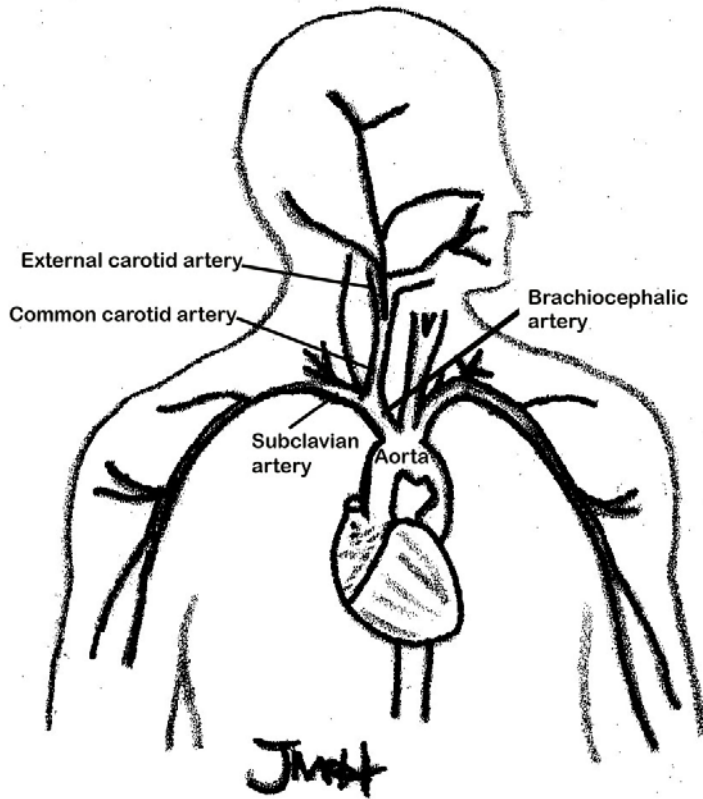
From Palmer, J.M. 1984. *Anatomy for Speech and Hearing*. Harper & Row Publishers, New York.



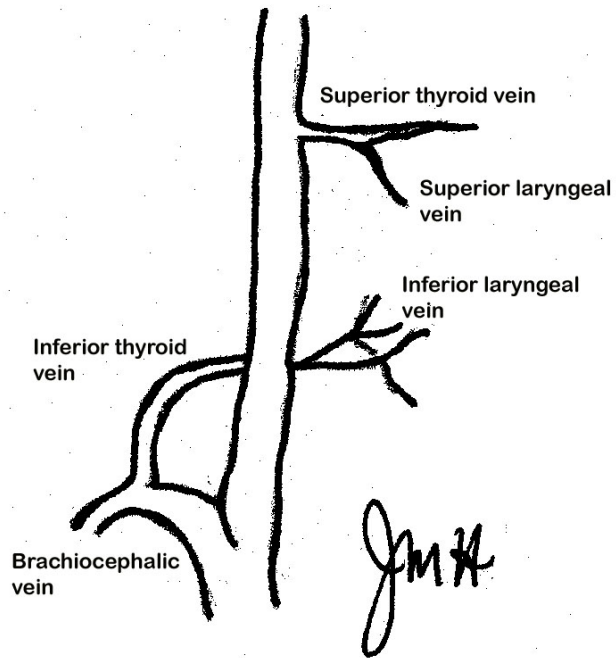
PUZZLER: What are the consequences of damage to the laryngeal nerves?

K. Laryngeal Blood Supply

1) Arteries



2) Veins



L. Lymphatic Drainage

HOMEWORK ASSIGNMENT: Read the following clinical information boxes and answer the questions that follow.

Palpation of the Larynx (p. 182):

Follow the instructions to palpate the larynx.

What is the prominent cartilage that people feel as the adam's apple?

What specific parts of the larynx can be palpated?

Referral in Voice Therapy (p. 184):

What is referral in voice therapy?

Why is referral important?

Vocal Hyperfunction (p. 190):

Define vocal hyperfunction:

What is laryngitis?

What intrinsic muscles contribute to vocal hyperfunction?

What is generally recommended as treatment?

Lecture Guide Questions

- 1) Be able to interpret the graphs in Figure 4-15 (Drapers study): describe volume, alveolar pressure, and muscle contractions. To acquire this recording, the subject would have to be simultaneously connected to three different devices: which device measured lung volume (general term)? Which device measured pressure (general term)?
- 2) What is V_r ? If lung volume is greater than V_r , does elastic recoil or muscular contraction provide the force for expiration? When lung volume is less than V_r ?
- 3) Define relaxation pressure, inspiratory pressure, and expiratory pressure. Imagine that you have a manometer in front of you and perform the breathing that you would use to measure each of the above pressures.
- 4) Why is alveolar pressure higher during the counting phase of the recording? What purpose does this serve? Which muscles are involved?
- 5) Which cartilages are elastic cartilage? Which cartilages are hyaline? Which cartilages may ossify with age? Does this affect voice? Why or why not?
- 6) What are the biological and nonbiological functions of the larynx?
- 7) Be able to identify and describe the regions and membranes of the larynx: aditus, vestibule, false vocal fold, ventricle, true vocal folds, atrium, cricothyroid membrane, quadrangular membrane, aryepiglottic folds, valleculae.
- 8) How do the laryngeal cartilages articulate with each other? What tissue connects one cartilage with another? How are these named?
- 9) Identify and describe the joints of the laryngeal cartilages. Which joints are movable? What movement(s) does each of the movable joints permit?
- 10) What connects to the vocal process of the arytenoid cartilages? What connects to the muscular process of the arytenoid cartilages (be specific)? What is the function of the triangular fovea of the arytenoid cartilages? What is the function of the epiglottis?
- 11) Identify the names, locations, origin, insertion, action, and nerves of the extrinsic and intrinsic laryngeal muscles. In general, how do the extrinsic muscles differ from the intrinsic muscles? How do the suprahyoid muscles differ from the infrahyoid muscles?
- 12) The muscle we called the thyroarytenoid in laboratory is, upon closer examination, considered two muscles: thyrovocalis and thyromuscularis. What are the origins, insertions, and actions of each muscle?
- 13) What are the activities/functions of the intrinsic laryngeal muscles?
- 14) Know the nerves, arteries, veins, and lymphatic vessels that supply the larynx. What functions do the different types of nerves support? Why is a blood and lymph supply needed to the larynx?
- 15) What are the consequences of damage to the laryngeal nerves?
- 16) Compare the actions of the intrinsic laryngeal muscles individually and in interactions among muscles. Why is it important to consider interactions among the intrinsic laryngeal muscles? (Hint: think of the wooden model in lab... is it accurate?)

End of Chapter Chapter 5 Questions (p. 210-213)

Topics covered in lecture: 1-11

Topics covered in laboratory: 1-11

CD-ROM Reviews and Practice Tests

Lecture topics: Lessons 05-01 through Lesson 05-03
Laboratory Topics: Lessons 05-01 through Lesson 05-03

A.D.A.M. Interactive Anatomy 4 Review

LOWER AIRWAY

Exercise 8.3 Larynx

- Close the Atlas Anatomy window. Click on File Open Content.
 - Click on the Dissectible Anatomy button and the Male button.
 - Click on the Anterior thumbnail icon. Click Open. Expand the window and set the Layer Indicator to 252.
 - Adjust the image to match the following diagram and zoom in.
1. Use the Identify tool to label the diagram below.



A. _____
B. _____
C. _____
D. _____

E. _____
F. _____
G. _____