

## CHAPTER ONE

# THE ANATOMY AND PHYSIOLOGY OF THE RESPIRATORY SYSTEM

### O B J E C T I V E S

**By the end of this chapter, the student should be able to:**

1. List the following three major components of the upper airway:
  - Nose
  - Oral cavity
  - Pharynx
2. List the primary functions of the upper airway:
  - Conductor of air
  - Humidify air
  - Prevent aspiration
  - Area for speech and smell
3. List the following three primary functions of the nose:
  - Filter
  - Humidify
  - Warm
4. Identify the following structures that form the outer portion of the nose:
  - Nasal bones
  - Frontal process of the maxilla
  - Lateral nasal cartilage
  - Greater alar cartilage
  - Lesser alar cartilages
  - Septal cartilage
  - Fibrous fatty tissue
5. Identify the following structures that form the internal portion of the nose:
  - Nasal septum
    - Perpendicular plate of the ethmoid
  - Vomer
  - Septal cartilage
6. Identify the following structures of the oral cavity:
  - Nasal bones
  - Frontal process of the maxilla
  - Cribriform plate of the ethmoid
  - Palatine process of the maxilla
  - Palatine bones
  - Soft palate
  - Nares
  - Vestibule
  - Vibrissae
  - Stratified squamous epithelium
  - Pseudostratified ciliated columnar epithelium
  - Turbinates (conchae)
    - Superior
    - Middle
    - Inferior
  - Paranasal sinuses
    - Maxillary
    - Frontal
    - Ethmoid
    - Sphenoid
  - Olfactory region
  - Choanae
  - Hard palate

*(continues)*

## 2 CHAPTER ONE

- Palatine process of the maxilla
  - Palatine bones
  - Soft palate
  - Uvula
  - Levator veli palatinum muscle
  - Palatopharyngeal muscles
  - Stratified squamous epithelium
  - Palatine arches
    - Palatoglossal arch
    - Palatopharyngeal arch
  - Palatine tonsils
7. Identify the location and structure of the following:
- Nasopharynx
    - Pseudostratified ciliated columnar epithelium
    - Pharyngeal tonsils (adenoids)
    - Eustachian tubes
  - Oropharynx
    - Lingual tonsil
    - Stratified squamous epithelium
    - Vallecula epiglottica
  - Laryngopharynx
    - Esophagus
    - Epiglottis
    - Aryepiglottic folds
    - Stratified squamous epithelium
8. Identify the following cartilages of the larynx:
- Thyroid cartilage
  - Cricoid cartilage
  - Epiglottis
  - Arytenoid cartilages
  - Corniculate cartilages
  - Cuneiform cartilages
9. Identify the structure and function of the following components of the interior portion of the larynx:
- False vocal folds
  - True vocal folds
  - Vocal ligament
  - Glottis (rima glottidis)
  - Epithelial lining above and below the vocal cords
10. Identify the structure and function of the following laryngeal muscles:
- Extrinsic muscles
    - Infrahyoid group
      - Sternohyoid
      - Sternothyroid
      - Thyrohyoid
      - Omohyoid
    - Suprahyoid group
      - Stylohyoid
      - Mylohyoid
      - Digastric
      - Geniohyoid
      - Stylopharyngeus
  - Intrinsic muscles
    - Posterior cricoarytenoid
    - Lateral cricoarytenoid
    - Transverse arytenoid
    - Thyroarytenoid
    - Cricothyroid
11. Describe the following ventilatory functions of the larynx:
- Primary function: Free flow of air
  - Secondary function: Valsalva's maneuver
12. Describe the histology of the tracheo-bronchial tree, including the following components:
- Components of the epithelial lining (upper and lower airways)
    - Pseudostratified ciliated columnar epithelium
    - Basement membrane
    - Basal cells
    - Mucous blanket
      - Sol layer
      - Gel layer
    - Goblet cells
    - Bronchial glands (submucosal glands)
    - Mucociliary transport mechanism
  - Components of the lamina propria
    - Blood vessels
    - Lymphatic vessels
    - Branches of the vagus nerve
    - Smooth-muscle fibers
    - Peribronchial sheath
    - Mast cells
      - Immunologic mechanism
  - Cartilaginous layer
13. Identify the location (generation) and structure of the following *cartilaginous* airways:
- Trachea

(continues)

- Carina
- Main stem bronchi
- Lobar bronchi
- Segmental bronchi
- Subsegmental bronchi
- 14.** Identify the location (generation) and structure of the following *noncartilaginous* airways:
  - Bronchioles
  - Terminal bronchioles
    - Canals of Lambert
    - Clara cells
- 15.** Describe how the cross-sectional area of the tracheobronchial tree changes from the trachea to the terminal bronchioles.
- 16.** Describe the structure and function of the following components of the bronchial blood supply:
  - Bronchial arteries
  - Azygos veins
  - Hemiazygos veins
  - Intercostal veins
- 17.** Describe the structure and function of the following sites of gas exchange:
  - Respiratory bronchioles
  - Alveolar ducts
  - Alveolar sacs
  - Primary lobule
    - Acinus
    - Terminal respiratory unit
    - Lung parenchyma
    - Functional units
- 18.** Discuss the structure and function of the following components of the alveolar epithelium:
  - Alveolar cell types
    - Type I cell (squamous pneumocyte)
    - Type II cell (granular pneumocyte)
  - Pulmonary surfactant
  - Pores of Kohn
  - Alveolar macrophages (Type III alveolar cells)
- 19.** Describe the structure and function of the interstitium, including the:
  - Tight space
  - Loose space
- 20.** Describe the structure and function of the following components of the pulmonary vascular system:
  - Arteries
    - Tunica intima
    - Tunica media
    - Tunica adventitia
  - Arterioles (resistance vessels)
    - Endothelial layer
    - Elastic layer
    - Smooth-muscle fibers
  - Capillaries
    - Single squamous epithelial layer
  - Venules and veins (capacitance vessels)
- 21.** Describe the structure and function of the following components of the lymphatic system:
  - Lymphatic vessels
  - Lymphatic nodes
  - Juxta-alveolar lymphatic vessels
- 22.** Describe how the following components of the autonomic nervous system relate to the neural control of the lungs:
  - Sympathetic nervous system
    - Neural transmitters
    - Epinephrine
    - Norepinephrine
    - Receptors
      - Beta<sub>2</sub> receptors
      - Alpha receptors
  - Parasympathetic nervous system
    - Neural transmitters
      - Acetylcholine
- 23.** Identify the effects the sympathetic and parasympathetic nervous systems have on the following:
  - Heart
  - Bronchial smooth muscle
  - Bronchial glands
  - Salivary glands
  - Stomach
  - Intestines
  - Eye
- 24.** Identify the following structures of the lungs:
  - Apex
  - Base
  - Mediastinal border
  - Hilum

(continues)

**4** CHAPTER ONE

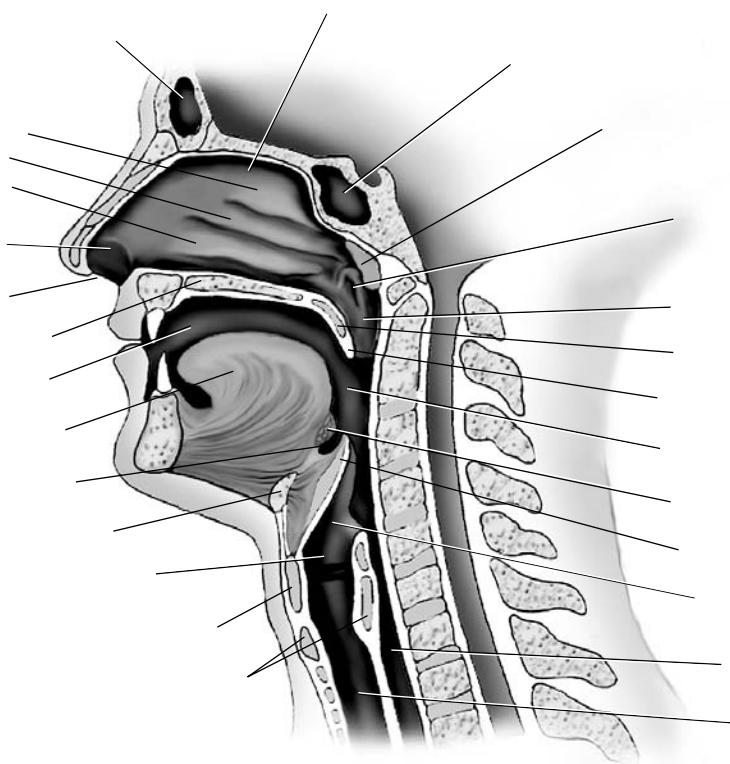
- Specific right lung structures
  - Upper lobe
  - Middle lobe
  - Lower lobe
  - Oblique fissure
  - Horizontal fissure
- Specific left lung structures
  - Upper lobe
  - Lower lobe
  - Oblique fissure
- 25.** Identify the following lung segments from the anterior, posterior, lateral, and medial views:
  - Right lung segments
    - Upper lobe
      - Apical
      - Posterior
      - Anterior
    - Middle lobe
      - Lateral
      - Medial
    - Lower lobe
      - Superior
      - Medial basal
      - Anterior basal
      - Lateral basal
      - Posterior basal
  - Left lung segments
    - Upper lobe
      - Upper division
        - 1) Apical-posterior
        - 2) Anterior
      - Lower division (lingular)
        - 1) Superior lingula
        - 2) Inferior lingula
    - Lower lobe
      - Superior
      - Anterior medial basal
      - Lateral basal
      - Posterior basal
- 26.** Identify the following components of the mediastinum:
  - Trachea
  - Heart
  - Major blood vessels
  - Nerves
  - Esophagus
  - Thymus gland
  - Lymph nodes
- 27.** Identify the following components of the pleural membranes:
  - Parietal pleurae
  - Visceral pleurae
  - Pleural cavity
- 28.** Identify the following components of the bony thorax:
  - Thoracic vertebrae
  - Sternum
    - Manubrium
    - Body
    - Xiphoid process
  - True ribs
  - False ribs
  - Floating ribs
- 29.** Describe the structure and function of the diaphragm and include the following:
  - Hemidiaphragms
  - Central tendon
  - Phrenic nerves
  - Lower thoracic nerves
- 30.** Describe the structure and function of the following accessory muscles of inspiration:
  - Scalene muscles
  - Sternocleidomastoid muscles
  - Pectoralis major muscles
  - Trapezius muscles
  - External intercostal muscles
- 31.** Describe the structure and function of the following accessory muscles of expiration:
  - Rectus abdominis muscles
  - External abdominis obliquus muscles
  - Internal abdominis obliquus muscles
  - Transversus abdominis muscles
  - Internal intercostal muscles

*Testbank Questions***THE UPPER AIRWAY****Objective 1**

1. List the three major components of the upper airway:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

2. Label the following structures of the upper airway:



**Figure 1-1** *Sagittal section of human head, showing the upper airway.*

**6** CHAPTER ONE

---

**Objective 2**

1. List the three primary functions of the upper airway:

- a. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- b. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- c. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Objective 3**

1. List the three primary functions of the nose:

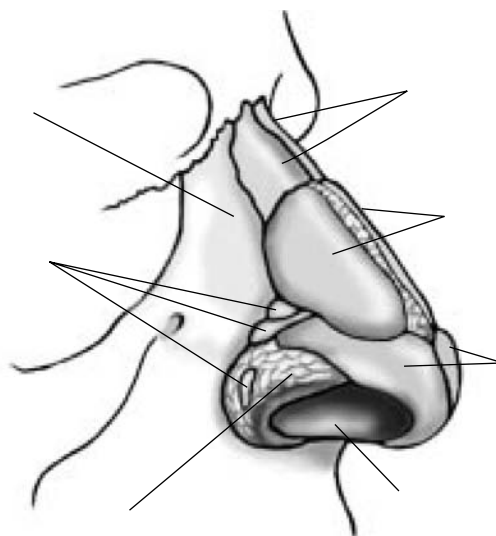
- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

**Objective 4**

1. Which of the following is/are a part of the nasal septum?

- I. nasal bone
  - II. vomer
  - III. palatine bone
  - IV. ethmoid bone
- A. I only
  - B. III only
  - C. II and IV only
  - D. II, III, and IV

2. Label the following structures that form the outer portion of the nose:



**Figure 1-2** *Structure of the nose.*

### Objective 5

1. The posterior portion of the nasal cavity floor is formed by the:
  - A. palatine process of the maxilla bone
  - B. soft palate
  - C. cribriform plate of the ethmoid bone
  - D. palatine bone
2. The posterior two-thirds of the nasal cavity is lined with:
  - A. vibrissae
  - B. simple squamous epithelium
  - C. lymphoid tissue
  - D. pseudostratified ciliated columnar epithelium

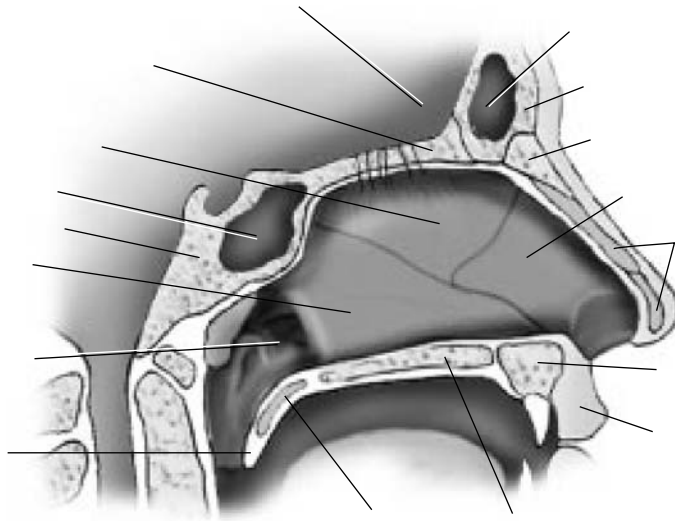
**8** CHAPTER ONE

---

3. List the four paranasal sinuses:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

4. Label the following structures of the internal portion of the nose:



---

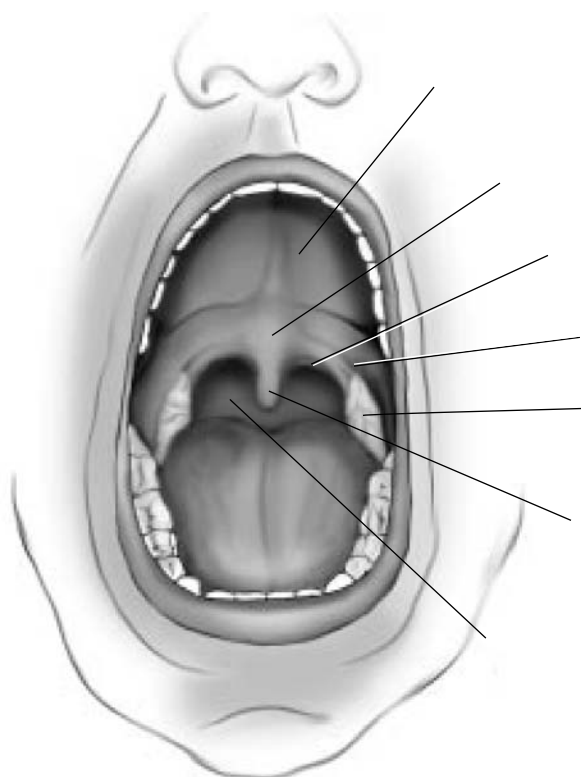
**Figure 1-3** *Sagittal section through the nose, showing the parts of the nasal septum.*

**Objective 6**

- 1. The soft palate is elevated by the:
  - A. levator veli palatine muscle
  - B. epiglottis
  - C. uvula
  - D. palatopharyngeal muscle



2. Label the following structures of the oral cavity:



**Figure 1-4** *Oral cavity.*

3. The oral cavity is lined with:
- A. simple cuboidal epithelium
  - B. stratified squamous epithelium
  - C. pseudostratified columnar epithelium
  - D. simple squamous epithelium

**10** CHAPTER ONE

---

**Objective 7**

1. The laryngopharynx is lined with:
  - A. simple squamous epithelium
  - B. pseudostratified columnar epithelium
  - C. stratified squamous epithelium
  - D. simple cuboidal epithelium
2. The adenoids are found in the:
  - A. nasopharynx
  - B. laryngopharynx
  - C. oropharynx
  - D. larynx
3. The epiglottis is attached anteriorly to the:
  - A. hyoid bone
  - B. thyroid cartilage
  - C. arytenoid cartilage
  - D. cricoid cartilage

---

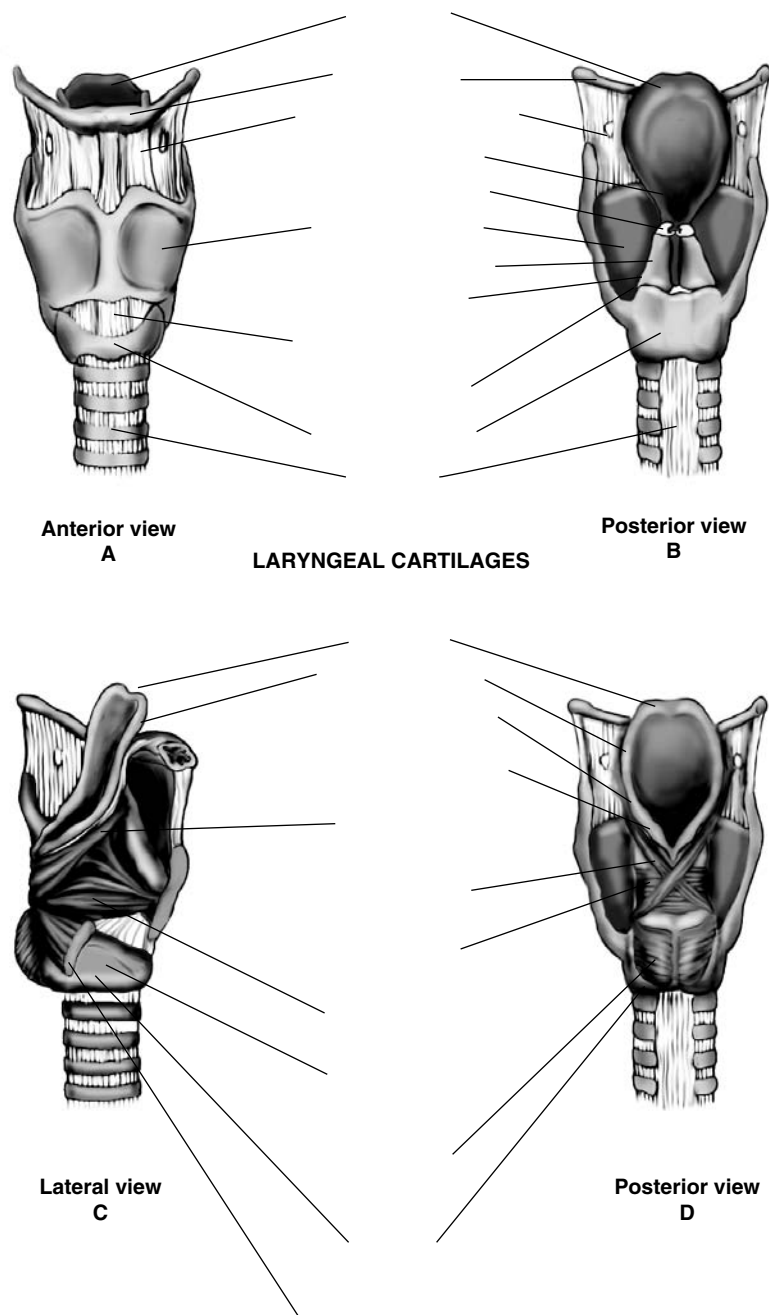
**THE LOWER AIRWAYS**

---

**Objective 8**

1. Which of the following is most superior?
  - A. cricoid cartilage
  - B. hyoid bone
  - C. arytenoid cartilage
  - D. thyroid cartilage
2. Which of the following is the largest cartilage of the larynx?
  - A. thyroid cartilage
  - B. corniculate cartilage
  - C. cuneiform cartilage
  - D. arytenoid cartilage

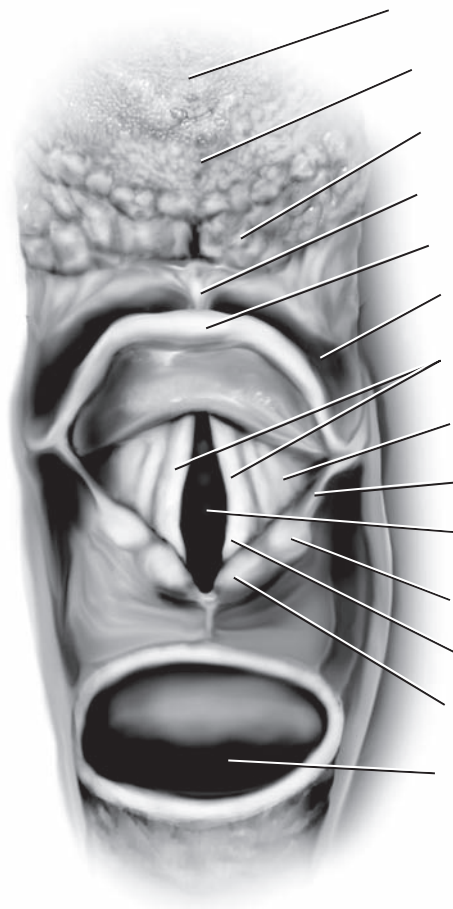
3. Label the following cartilages of the larynx:



**Figure 1-5** *Cartilages of the larynx.*

**Objective 9**

1. Posteriorly, the vocal folds attach to the:
  - A. corniculate cartilage
  - B. thyroid cartilage
  - C. cricoid cartilage
  - D. arytenoid cartilage
2. Above the vocal cords, the laryngeal mucosa is composed of:
  - A. stratified squamous epithelium
  - B. pseudostratified columnar epithelium
  - C. simple cuboidal epithelium
  - D. simple squamous epithelium
3. Label the following structures that are observed in the superior view of the vocal cords:

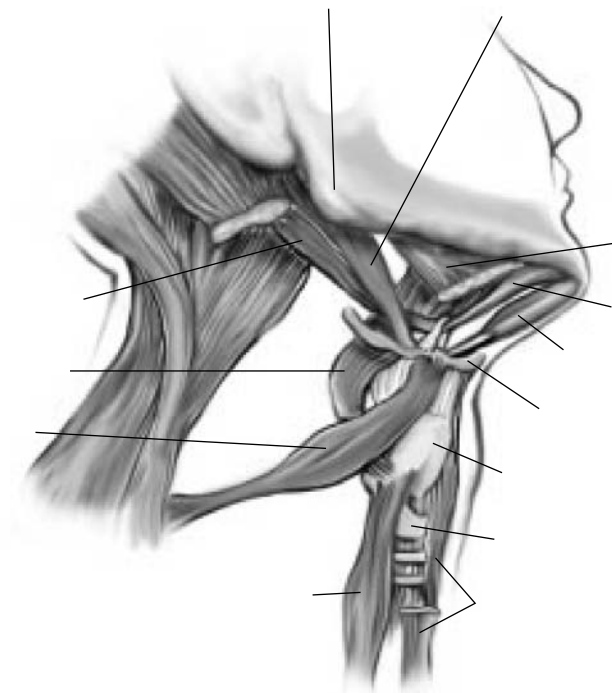


---

**Figure 1-6** *Superior view of vocal folds (cords).*

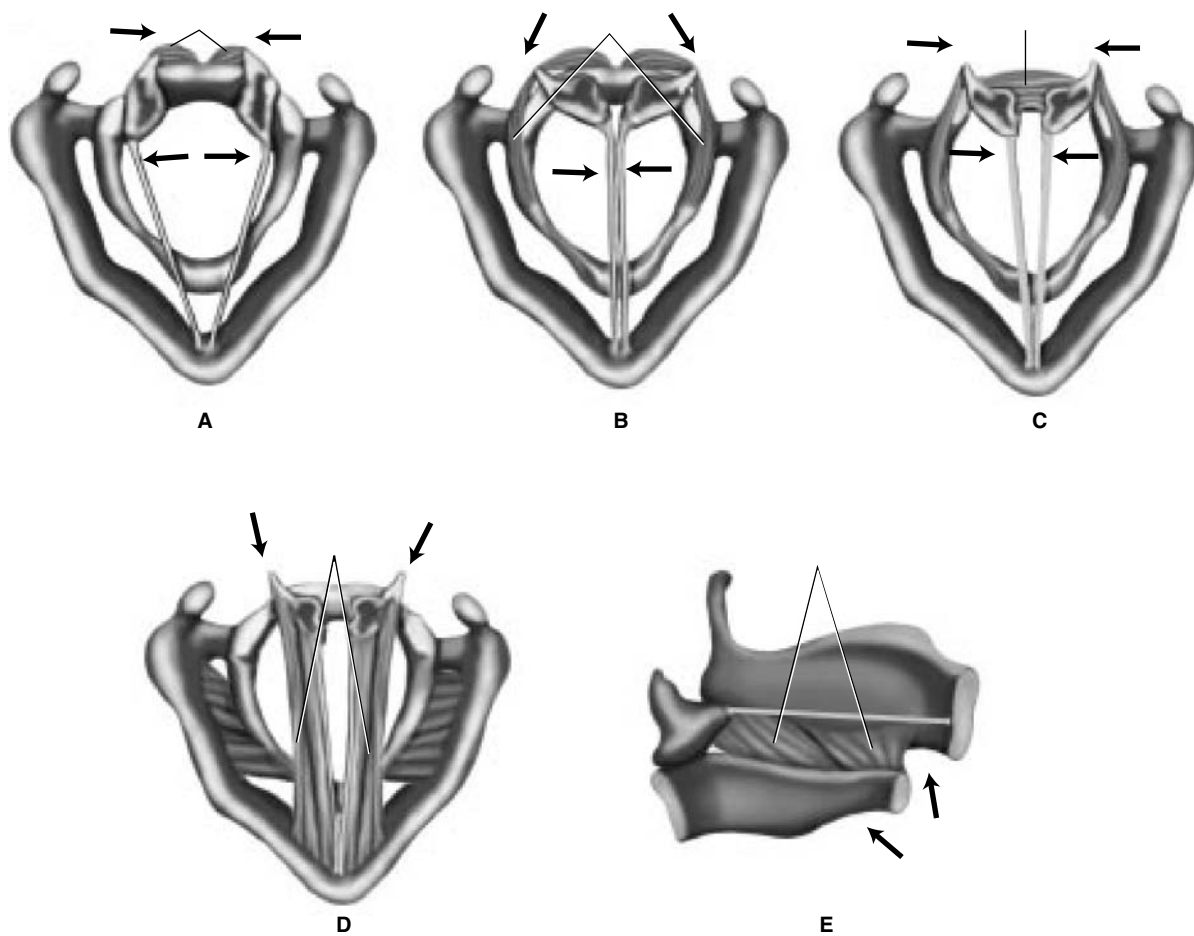
**Objective 10**

1. Label the following *extrinsic* laryngeal muscles:



**Figure 1-7** *Extrinsic laryngeal muscles.*

2. Label the following *intrinsic* laryngeal muscles:



**Figure 1-8** *Intrinsic laryngeal muscles.*

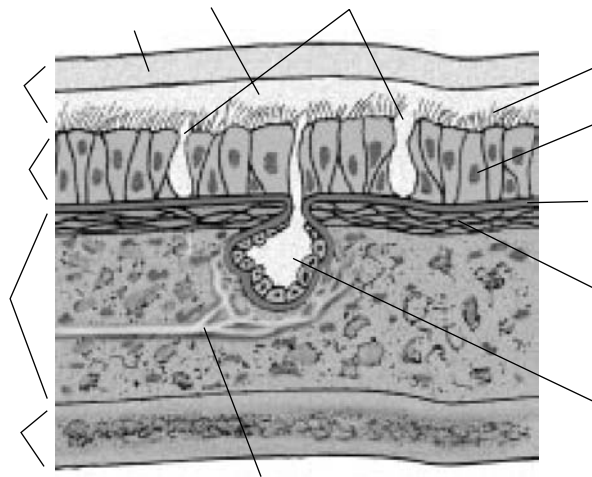
### Objective 11

1. During a quiet inspiration, the vocal folds:
  - I. abduct
  - II. move toward the midline
  - III. adduct
  - IV. move apart
  - A. I only
  - B. III only
  - C. I and IV only
  - D. II and III only

2. During exhalation, the vocal folds:
  - I. abduct
  - II. move toward the midline
  - III. adduct
  - IV. move apart
  - A. I only
  - B. III only
  - C. I and IV only
  - D. II and III only

### Objective 12

1. Label the following components of the epithelial lining of the tracheobronchial tree:



**Figure 1-9** Epithelial lining of the tracheobronchial tree.

2. The epithelial lining of the tracheobronchial tree is primarily composed of:
  - A. stratified squamous epithelium
  - B. simple squamous epithelium
  - C. pseudostratified ciliated, columnar epithelium
  - D. simple cuboidal epithelium
3. The layer of mucus closest to the epithelium in the tracheobronchial tree is called the:
  - A. sol layer
  - B. mucous layer
  - C. bronchial layer
  - D. gel layer

**16** CHAPTER ONE

---

4. In the tracheobronchial tree, the mast cells are found in the:
  - I. pseudostratified ciliated, columnar epithelium
  - II. smooth muscle fibers
  - III. cartilage
  - IV. intra-alveolar septa
    - A. I and III only
    - B. II only
    - C. II and IV only
    - D. I, II, and IV only
5. Most of the mucus that lines the lumen of the tracheobronchial tree is produced by the:
  - I. mast cells
  - II. submucosal glands
  - III. goblet cells
  - IV. bronchial glands
    - A. I only
    - B. III only
    - C. IV only
    - D. II and IV only
6. Lymph vessels and nerves are found in which of the following structures of the trachea?
  - A. epithelial lining
  - B. lamina propria
  - C. cartilaginous layer
  - D. squamous, nonciliated epithelium

**Objective 13**

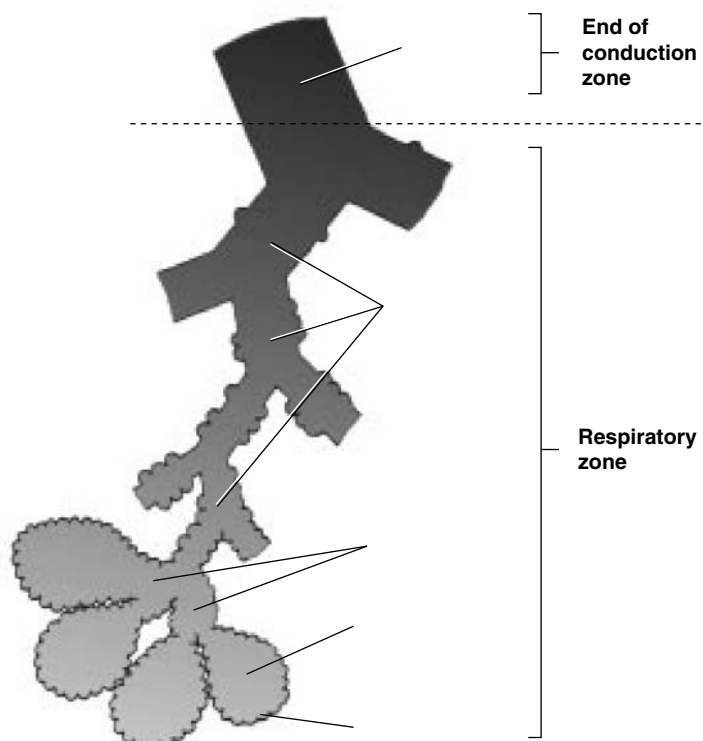
1. The length of the trachea is about:
  - A. 8–10 cm long
  - B. 11–13 cm long
  - C. 14–16 cm long
  - D. 17–19 cm long
2. Which of the following is called the third generation of the tracheobronchial tree?
  - A. segmental bronchi
  - B. subsegmental bronchi
  - C. bronchioles
  - D. terminal bronchioles
3. The trachea is considered what generation of the tracheobronchial tree?
  - A. 0 generation
  - B. first generation
  - C. second generation
  - D. third generation
4. Which of the following represents a correct sequence (from the mouth to the alveoli) of the tracheobronchial tree?
  - A. bronchioles, lobar bronchi, terminal bronchioles, and alveoli
  - B. respiratory bronchioles, terminal bronchioles, bronchioles, and alveoli ducts
  - C. bronchioles, terminal bronchioles, respiratory bronchioles, and alveoli ducts
  - D. main stem bronchi, trachea, terminal bronchioles, and respiratory bronchioles



## THE SITES OF GAS EXCHANGE

### Objective 14

1. Using the following schematic drawing, label the anatomic structures distal to the terminal bronchioles:



**Figure 1–10** Schematic drawing of the anatomic structures distal to the terminal bronchioles; collectively, these are referred to as the primary lobule.

2. Cartilage is absent in which of the following structures of the tracheobronchial tree?
  - I. bronchioles
  - II. respiratory bronchioles
  - III. segmental bronchi
  - IV. terminal bronchioles
  - A. III only
  - B. IV only
  - C. I and IV only
  - D. I, II, and IV only

**18** CHAPTER ONE

---

3. Terminal bronchioles permit gas to enter into adjacent alveoli via the:
- A. channels of Lambert
  - B. alveolar ducts
  - C. pores of Kohn
  - D. none of the above

**Objective 15**

1. Which of the following has the smallest cross-sectional area?
- A. trachea
  - B. terminal bronchioles
  - C. segmental bronchi
  - D. lobar bronchi

**Objective 16**

1. Which of the following is/are nourished by the bronchial arteries?
- I. respiratory bronchioles
  - II. subsegmental bronchi
  - III. alveolar ducts
  - IV. terminal bronchioles
  - V. segmental bronchi
- A. I only
  - B. II only
  - C. III only
  - D. II, IV, and V only
2. About one-third of the bronchial venous blood returns to the right atrium by way of the:
- I. azygos veins
  - II. pulmonary veins
  - III. hemiazygos veins
  - IV. intercostal veins
- A. II only
  - B. III and IV only
  - C. II and III only
  - D. I, III, and IV only

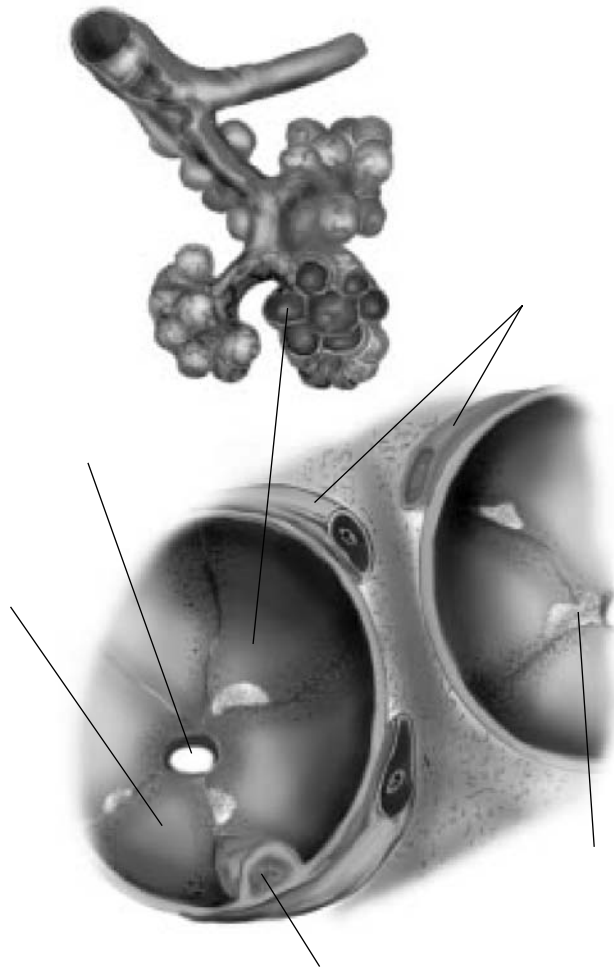
**Objective 17**

1. Ciliated cells disappear at which level of the tracheobronchial tree?
- A. bronchioles
  - B. terminal bronchioles
  - C. respiratory bronchioles
  - D. alveoli ducts
2. What is the function of the primary lobule?
- A. circulate blood
  - B. create mucus
  - C. filter gas
  - D. gas exchange

**Objective 18**

1. About what percent of the total alveolar surface is composed of the Type I cells?
  - A. 65%
  - B. 75%
  - C. 85%
  - D. 95%
2. The average diameter of the lung's alveoli ranges between:
  - A. 1–10 mm
  - B. 25–65 mm
  - C. 75–300  $\mu$
  - D. 500–1000  $\mu$
3. The average surface area available for gas exchange is about:
  - A. 20 square meters
  - B. 50 square meters
  - C. 70 square meters
  - D. 100 square meters
4. Small holes in the walls of the interalveolar septa are called:
  - A. loose spaces
  - B. pores of Kohn
  - C. anastomoses
  - D. canals of Lambert

5. Label the following components of the alveolar-capillary network:



---

**Figure 1-11** *Alveolar-capillary network.*

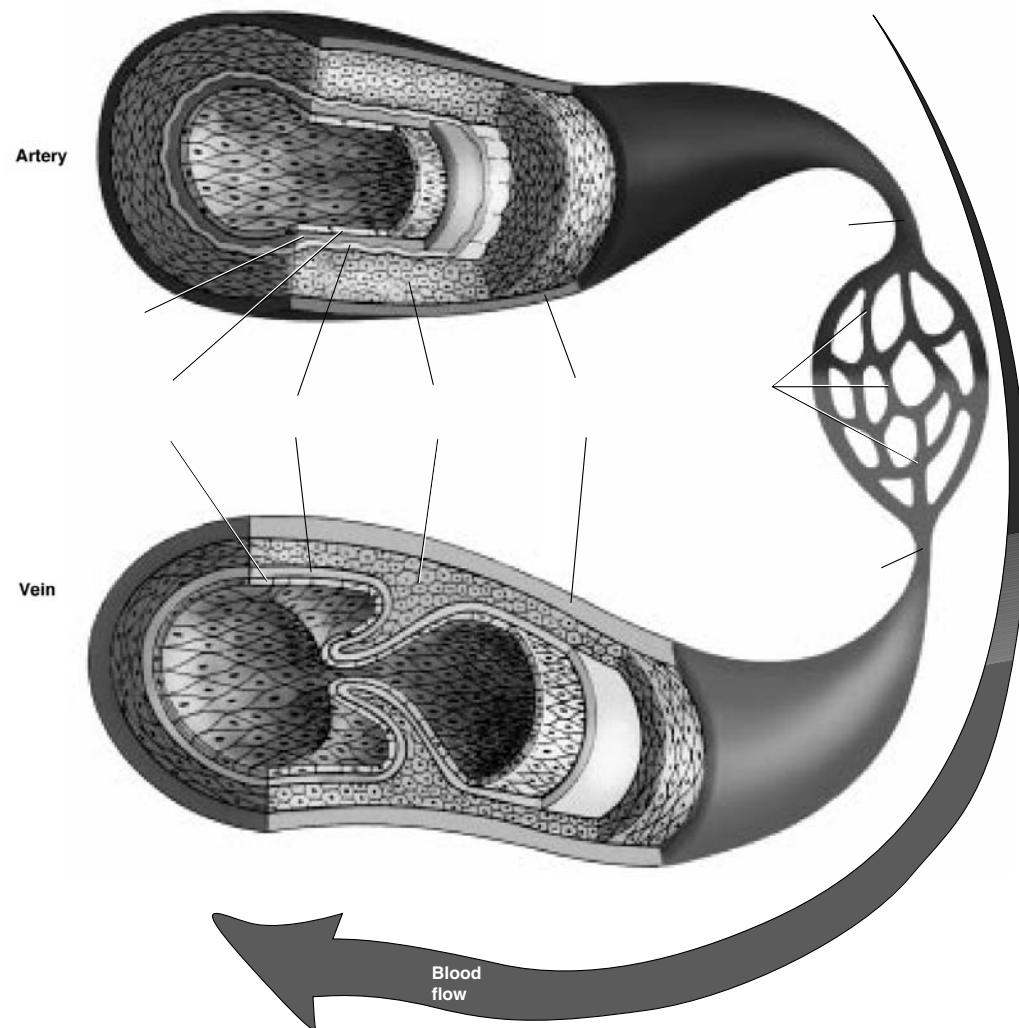
**Objective 19**

1. The alveolar-capillary clusters are surrounded, supported, and shaped by the:
  - A. pores of Kohn
  - B. primary lobules
  - C. interstitium
  - D. tight spaces
2. The interstitium is a space between the:
  - A. alveolar walls
  - B. alveoli and capillaries
  - C. alveoli and bronchioles
  - D. nerves and lymph glands

**PULMONARY VASCULAR SYSTEM****Objective 20**

1. The external diameter of the pulmonary capillaries is about:
  - A. 10  $\mu$
  - B. 20  $\mu$
  - C. 30  $\mu$
  - D. 40  $\mu$
2. Which of the following are called capacitance vessels?
  - A. arterioles
  - B. capillaries
  - C. venules
  - D. veins

3. Using the following schematic drawing, label the components of the major blood vessels:

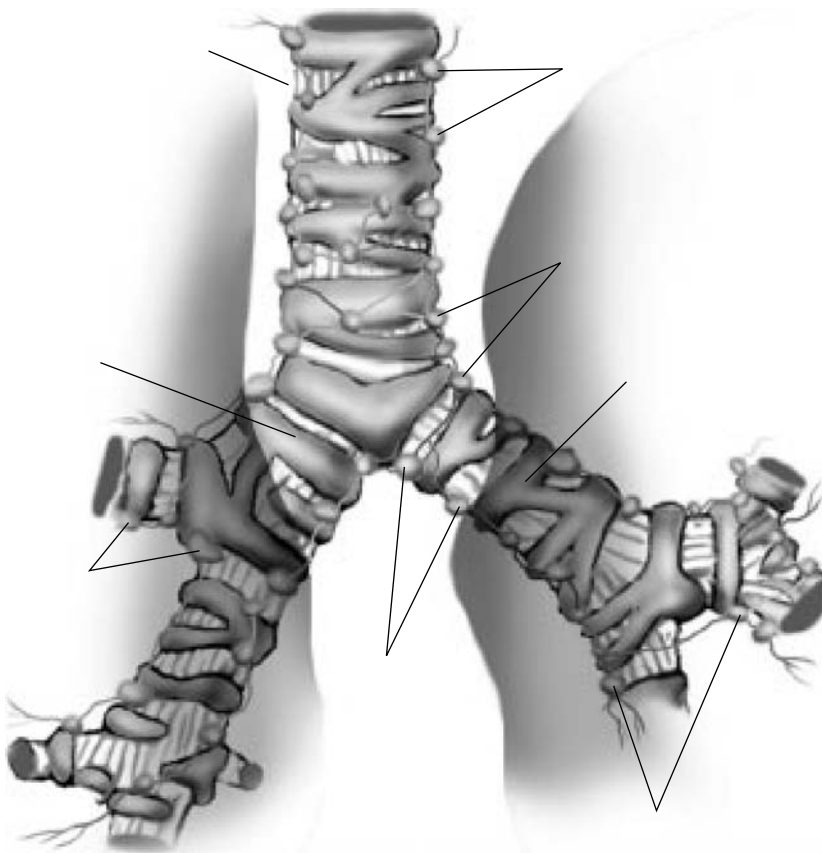


**Figure 1-12** Schematic drawing of the components of the pulmonary blood vessels.

## THE LYMPHATIC SYSTEM

### Objective 21

1. Label the following lymph nodes associated with the trachea and the right and left main stem bronchi:



**Figure 1-13** *Lymph nodes associated with the trachea and the right and left main stem bronchi.*

### 2. Lymphatic vessels:

- I. are more numerous over the lower lobe as compared to the upper lobe.
  - II. start in the region of the alveolar ducts and flow toward the hilum.
  - III. flow around the outer surface of the lungs to reach the hilum.
  - IV. are more numerous over the left lower lobe as compared to the right lower lobe.
- A. I and II only
  - B. II and III only
  - C. II, III, and IV only
  - D. I, II, III, and IV

**24** CHAPTER ONE

---

3. What function do the lymphatic vessels in the lung perform?
- A. fluid removal
  - B. gas exchange
  - C. phagocytosis
  - D. promote mucus production

**Objective 22**

1. Which of the following is/are associated with the sympathetic nervous system?
- I. epinephrine
  - II. beta<sub>2</sub> receptors
  - III. norepinephrine
  - IV. alpha receptors
- A. III only
  - B. II and IV only
  - C. II, III, and IV only
  - D. I, II, III, and IV

---

**NEURAL CONTROL OF THE LUNGS**

---

**Objective 23**

1. In the open (blank) spaces, compare and contrast the effects of the sympathetic and parasympathetic nervous system on the effector sites identified below:

---

**Some Effects of Autonomic Nervous System Activity**

---

EFFECTOR SITE	SYMPATHETIC NERVOUS SYSTEM	PARASYMPATHETIC NERVOUS SYSTEM
Heart		
Bronchial smooth muscle		
Bronchial glands		
Salivary glands		
Stomach		
Intestines		
Eye		

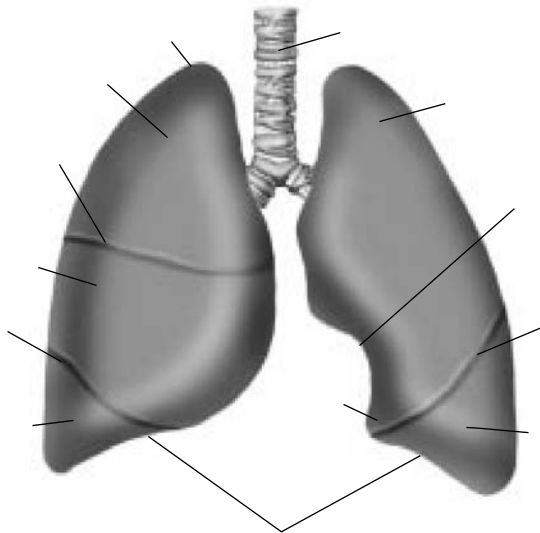
---



## THE LUNGS

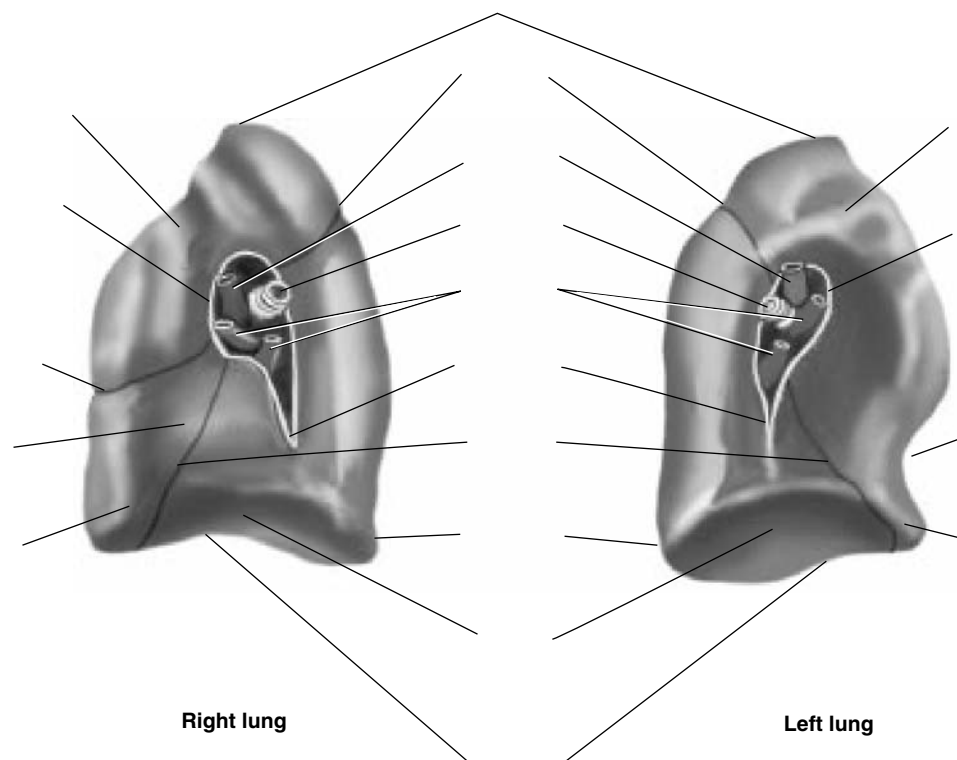
### Objective 24

1. The right and left main stem bronchi, blood vessels, and nerves enter and exit lungs through the:
  - A. horizontal fissure
  - B. mediastinum
  - C. oblique fissure
  - D. hilum
2. Anteriorly, the base of the lungs extends to about the level of which of the following ribs?
  - A. 5th rib
  - B. 6th rib
  - C. 7th rib
  - D. 8th rib
3. Posteriorly, the base of the lungs extends to about the level of which of the following ribs?
  - A. 8th rib
  - B. 9th rib
  - C. 10th rib
  - D. 11th rib
4. Label the following structures of the anterior portion of the lungs:



**Figure 1-14** *Anterior view of the lungs.*

5. Label the following structures of the medial portion of the lungs:



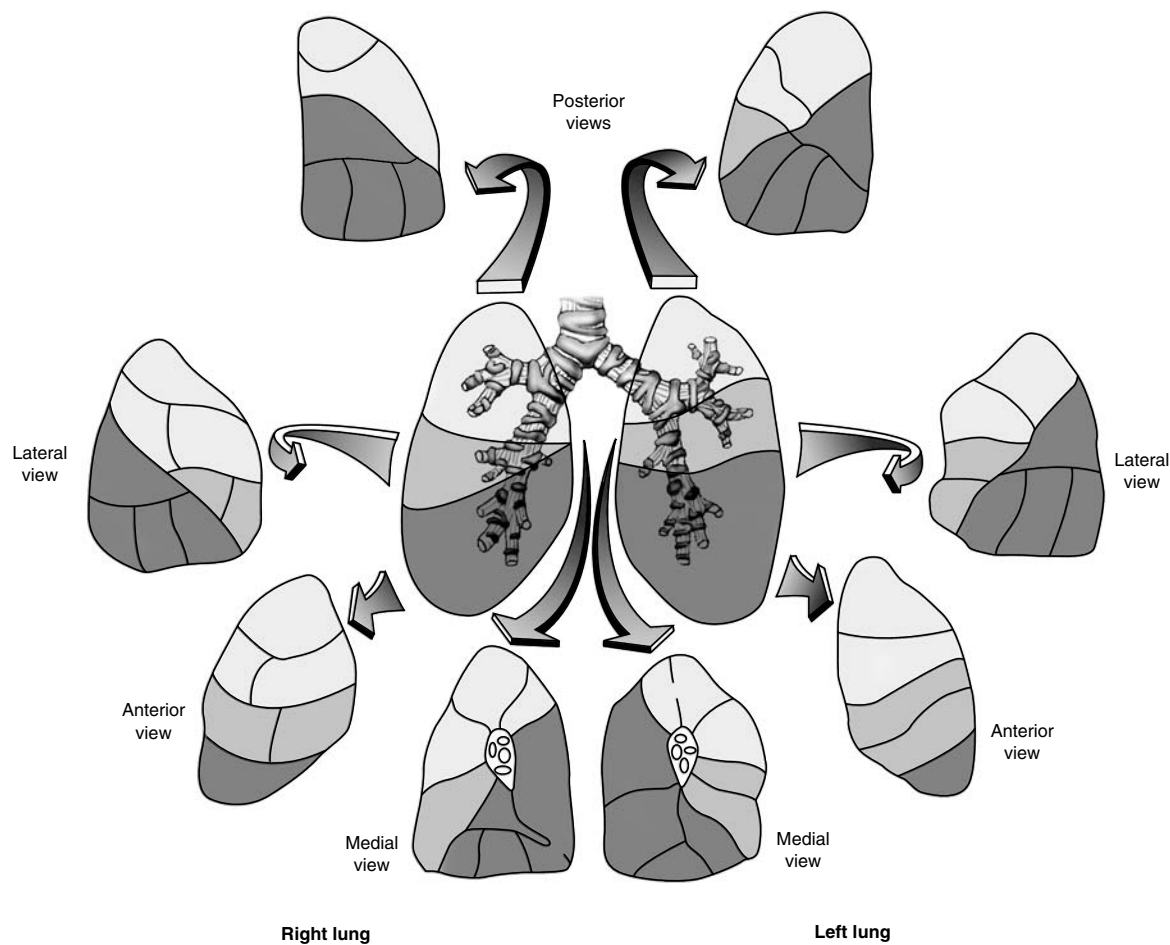
**Figure 1-15** *Medial view of the lungs.*

### Objective 25

1. The inferior lingula lung segment is found in the:
  - A. right lung, upper lobe
  - B. left lung, upper division of upper lobe
  - C. right lung, lower lobe
  - D. left lung, lower division of upper lobe

2. Match the number of the lung segments shown in the box to the different views of the lungs shown as shaded sections below:

Right lung		Left lung	
Upper lobe		Upper lobe	
Apical	1	Upper division	
Posterior	2	Apical/Posterior	1 & 2
Anterior	3	Anterior	3
Middle lobe		Lower division (lingular)	
Lateral	4	Superior lingula	4
Medial	5	Inferior lingula	5
Lower lobe		Lower lobe	
Superior	6	Superior	6
Medial basal	7	Anterior medial basal	7 & 8
Anterior basal	8	Lateral basal	9
Lateral basal	9	Posterior basal	10
Posterior basal	10		



**Figure 1-16** Lung segments. Although the segment subdivisions of the right and left lungs are similar, there are some slight anatomic differences, which are noted by combined names and numbers. Because of these slight variations, some workers consider that, technically, there are only eight segments in the left lung and that the apical-posterior segment is number 1 and the anteromedial is number 6.

## THE MEDIASTINUM, PLEURAL MEMBRANES, AND THORAX

---

### Objective 26

1. The mediastinum contains which of the following?
  - I. thymus gland
  - II. lymph nodes
  - III. trachea
  - IV. the great vessels
  - A. I only
  - B. III only
  - C. II, III, and IV only
  - D. I, II, III, and IV

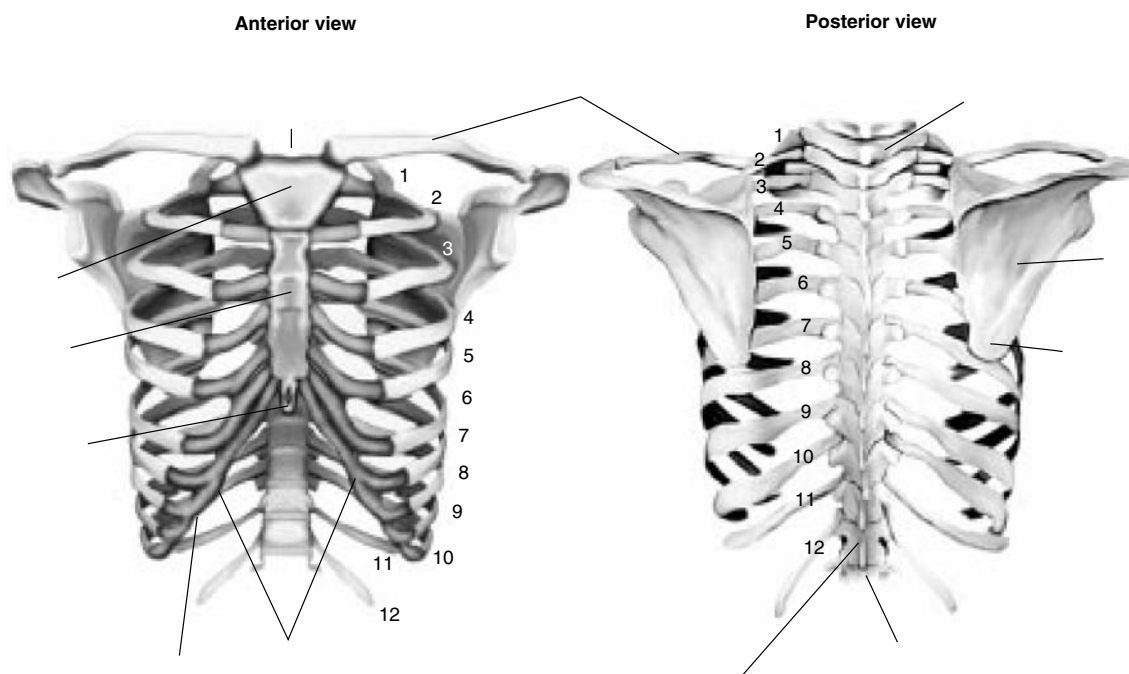
### Objective 27

1. The parietal pleura lines the:
  - A. heart
  - B. liver
  - C. lung
  - D. thorax
2. Which of the following lines the inside of the thoracic wall?
  - A. linea alba
  - B. parietal pleurae
  - C. fascia
  - D. mesoderm

### Objective 28

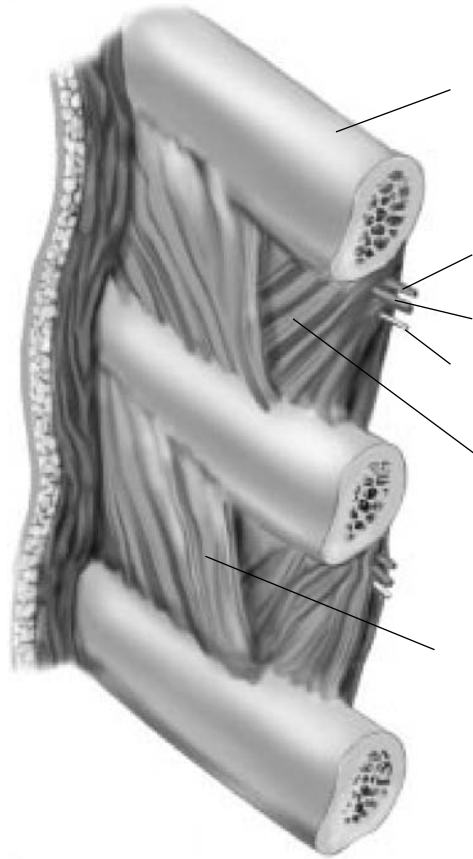
1. Which of the following are part of the sternum?
  - I. oblique fissure
  - II. xiphoid process
  - III. floating ribs
  - IV. manubrium
  - A. I and II only
  - B. II and III only
  - C. III and IV only
  - D. II and IV only
2. Ribs eight, nine, and ten are referred to as the:
  - A. floating ribs
  - B. external intercostal ribs
  - C. false ribs
  - D. true ribs

3. Label the following components of the thorax:



**Figure 1-17** *The thorax.*

4. Label the following components of the intercostal space:



---

**Figure 1-18** *The intercostal space.*

### **Objective 29**

1. The primary motor innervation of each hemidiaphragm is supplied by the:
  - I. vagus nerve (cranial nerve X)
  - II. phrenic nerves
  - III. lower thoracic nerves
  - IV. glossopharyngeal nerve (cranial nerve IX)
    - A. I only
    - B. II only
    - C. IV only
    - D. II and III only

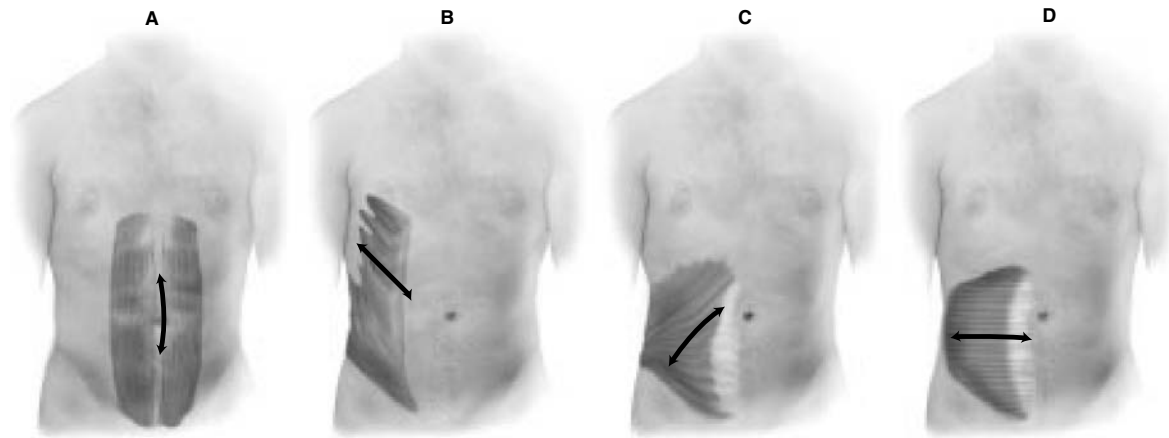
**Objective 30**

1. When used as accessory muscles of inspiration, the scalene muscles elevate the following ribs:
  - I. first rib
  - II. second rib
  - III. third rib
  - IV. fourth rib
  - V. fifth rib
  - A. I only
  - B. II only
  - C. I and II only
  - D. I, II, III, and IV only
2. During inspiration, the external intercostal muscles cause the ribs to move:
  - I. upward
  - II. inward
  - III. downward
  - IV. outward
  - A. I only
  - B. III only
  - C. II only
  - D. I and IV only

**Objective 31**

1. During the expiration, the internal intercostal muscles cause the ribs to move:
  - I. upward
  - II. inward
  - III. downward
  - IV. outward
  - A. II only
  - B. IV only
  - C. II and III only
  - D. I and IV only

2. Label the following accessory muscles of expiration:



**Figure 1-19** Accessory muscles of expiration.

### Objectives 30 and 31

#### Matching

1. On the lines under *Column A*, write the letter(s) from *Column B* that identify muscles considered to be muscles of *inspiration* or muscles of *expiration*. Muscles in *Column B* may be used once, more than once, or not at all.

#### COLUMN A

*Muscles of Inspiration*  
(including accessory muscles)

---



---

*Muscles of Expiration*  
(including accessory muscles)

---



---

#### COLUMN B

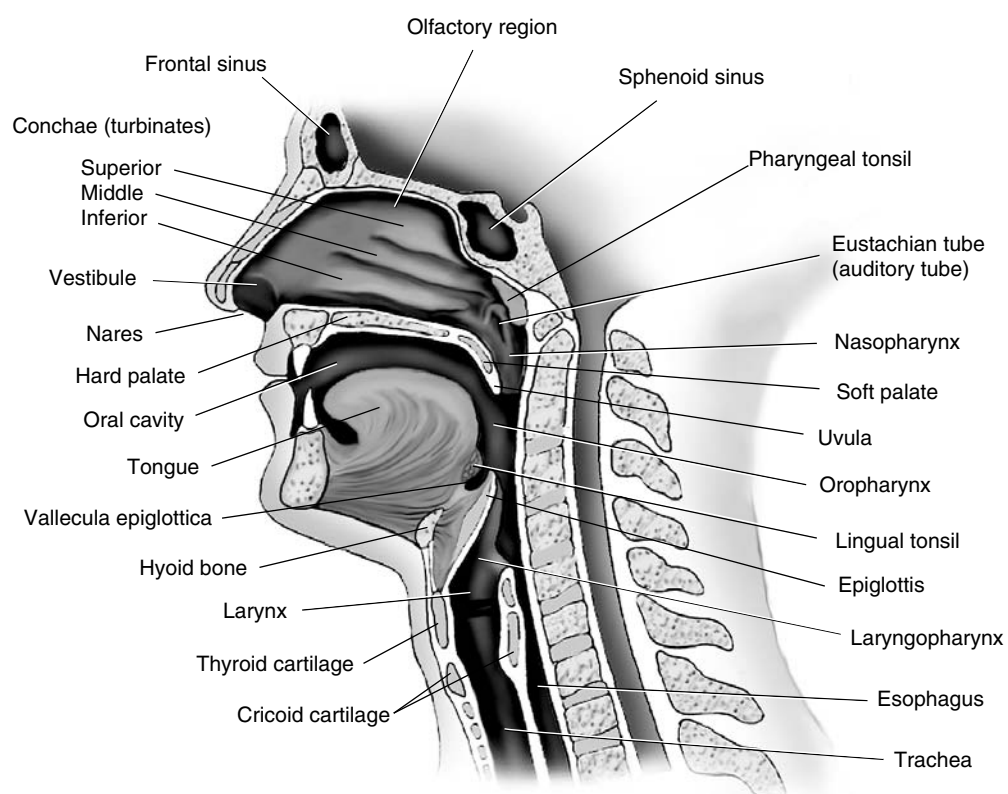
- a. transverse abdominis muscle(s)
- b. pectoralis major muscle(s)
- c. internal intercostal muscle(s)
- d. phrenic muscle(s)
- e. scalene muscle(s)
- f. external oblique muscle(s)
- g. rectus abdominis muscle(s)
- h. gluteus maximus muscle(s)
- i. external intercostal muscle(s)
- j. deltoid muscle(s)
- k. internal oblique muscle(s)
- l. sternocleidomastoid muscle(s)
- m. trapezius muscle(s)



## Answers to Testbank Questions

### Objective 1

1. List the three major components of the upper airway:
  - a. nose
  - b. oral cavity
  - c. pharynx
2. Label the following structures of the upper airway:



**Figure 1-1** *Sagittal section of human head, showing the upper airway.*

### Objective 2

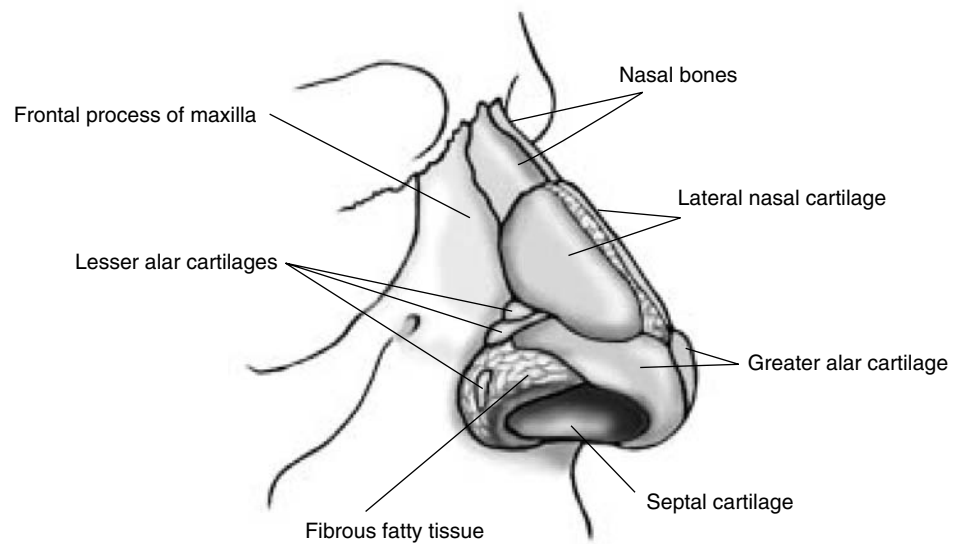
1. List the three primary functions of the upper airway:
  - a. To act as a conductor of air
  - b. To prevent foreign materials from entering the tracheobronchial tree
  - c. To serve as an important area involved in speech and smell

**Objective 3**

1. List the three primary functions of the nose:
  - a. filter
  - b. humidify
  - c. warm

**Objective 4**

1. Which of the following is/are a part of the nasal septum?
  - C. II and IV only
2. Label the following structures that form the outer portion of the nose:

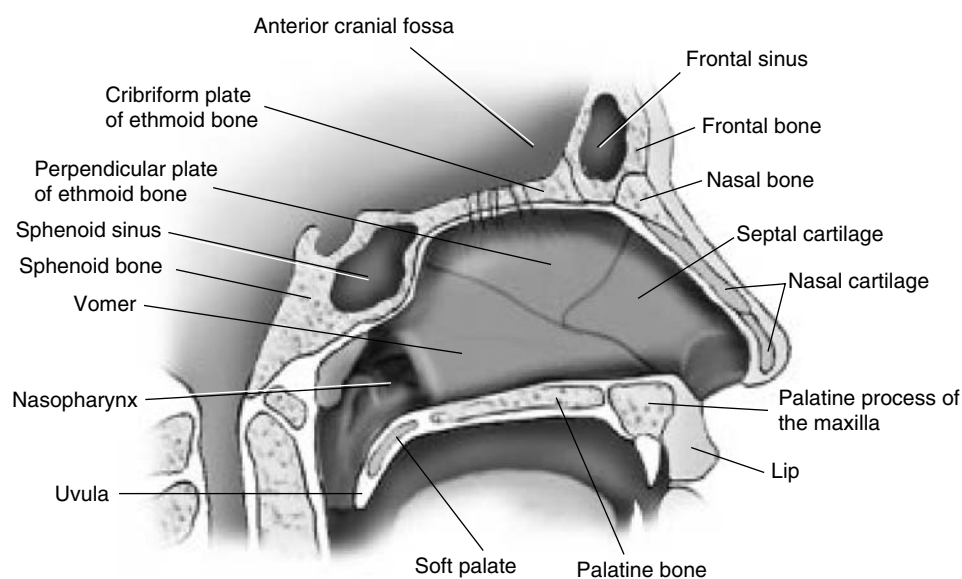


---

**Figure 1-2** *Structure of the nose.*

**Objective 5**

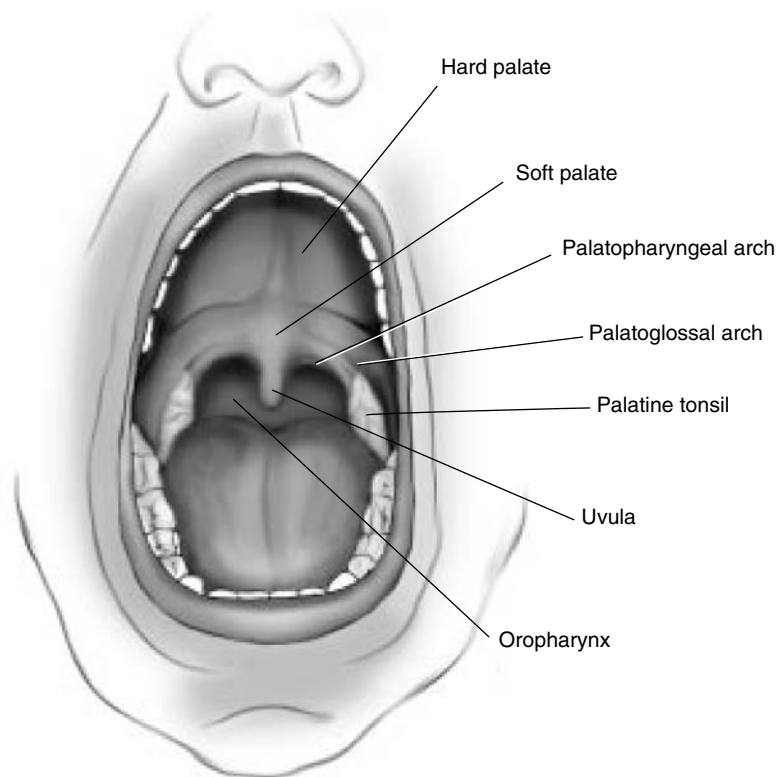
1. The posterior portion of the nasal cavity floor is formed by the:  
B. soft palate
2. The posterior two-thirds of the nasal cavity is lined with  
D. pseudostratified ciliated columnar epithelium
3. List the four paranasal sinuses:  
a. maxillary  
b. frontal  
c. ethmoid  
d. sphenoid
4. Label the following structures of the internal portion of the nose:



**Figure 1-3** *Sagittal section through the nose, showing the parts of the nasal septum.*

**Objective 6**

1. The soft palate is elevated by the:  
A. levator veli palatine muscle
2. Label the following structures of the oral cavity:



**Figure 1-4** *Oral cavity.*

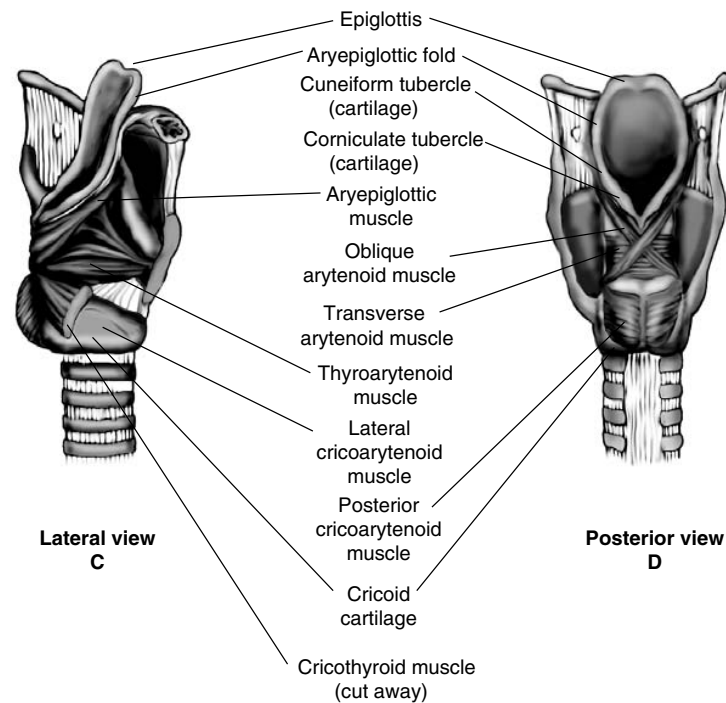
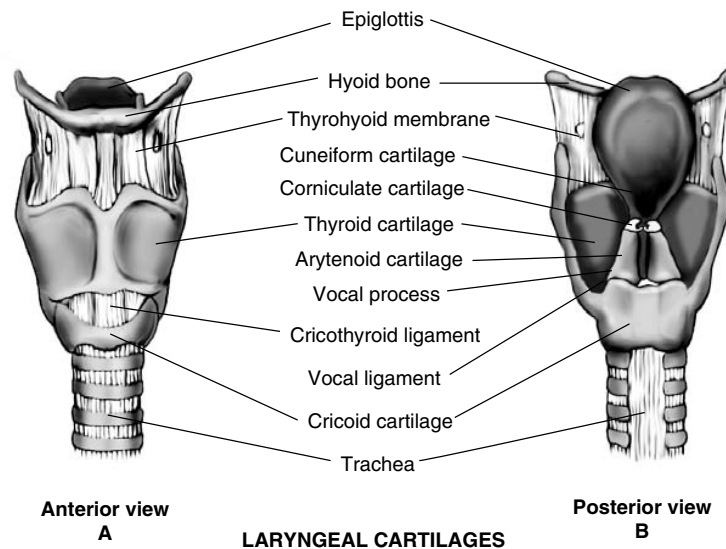
3. The oral cavity is lined with:  
B. stratified squamous epithelium

**Objective 7**

1. The laryngopharynx is lined with:  
C. stratified squamous epithelium
2. The adenoids are found in the:  
A. nasopharynx
3. The epiglottis is attached anteriorly to the:  
B. thyroid cartilage

## Objective 8

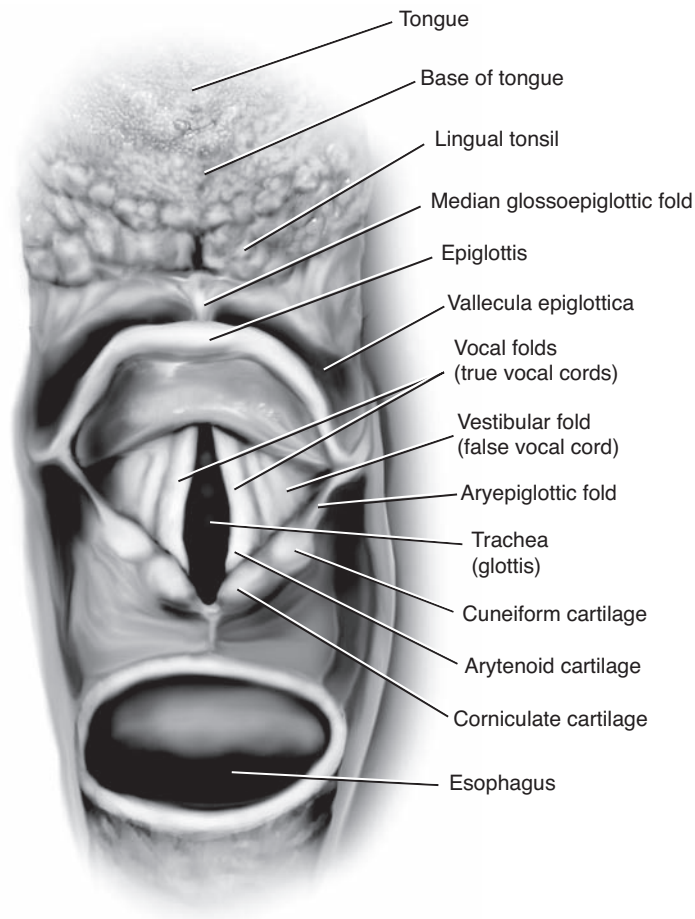
- Which of the following is most superior?  
B. hyoid bone
- Which of the following is the largest cartilage of the larynx?  
A. thyroid cartilage
- Label the following cartilages of the larynx:



**Figure 1-5** *Cartilages of the larynx.*

**Objective 9**

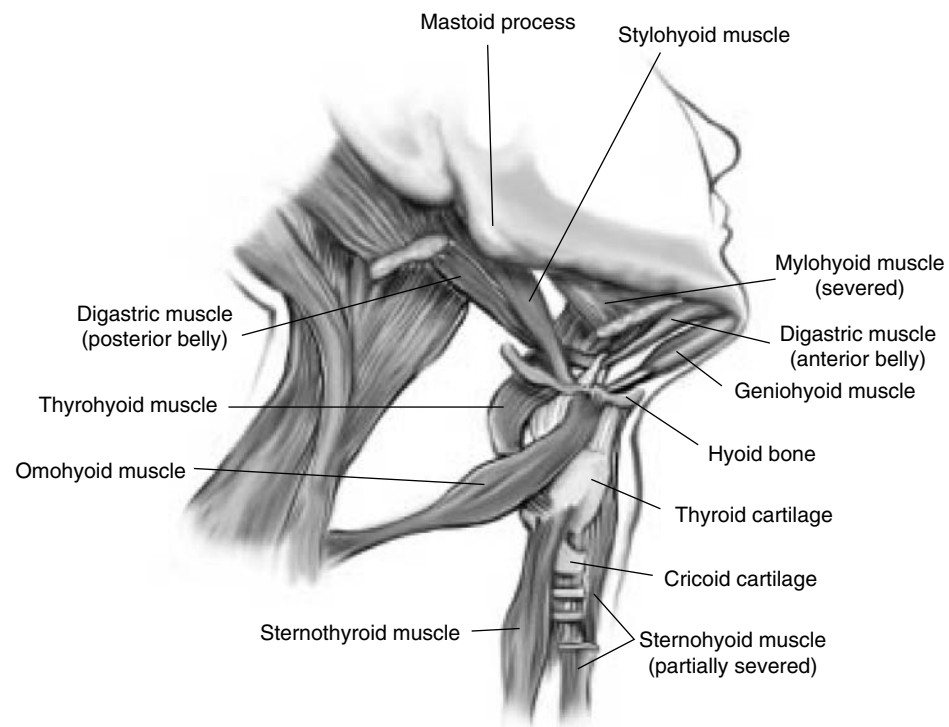
1. Posteriorly, the vocal folds attach to the:  
D. arytenoid cartilage
2. Above the vocal cords, the laryngeal mucosa is composed of:  
A. stratified squamous epithelium
3. Label the following structures that are observed in the superior view of the vocal cords:



**Figure 1-6** Superior view of vocal folds (cords).

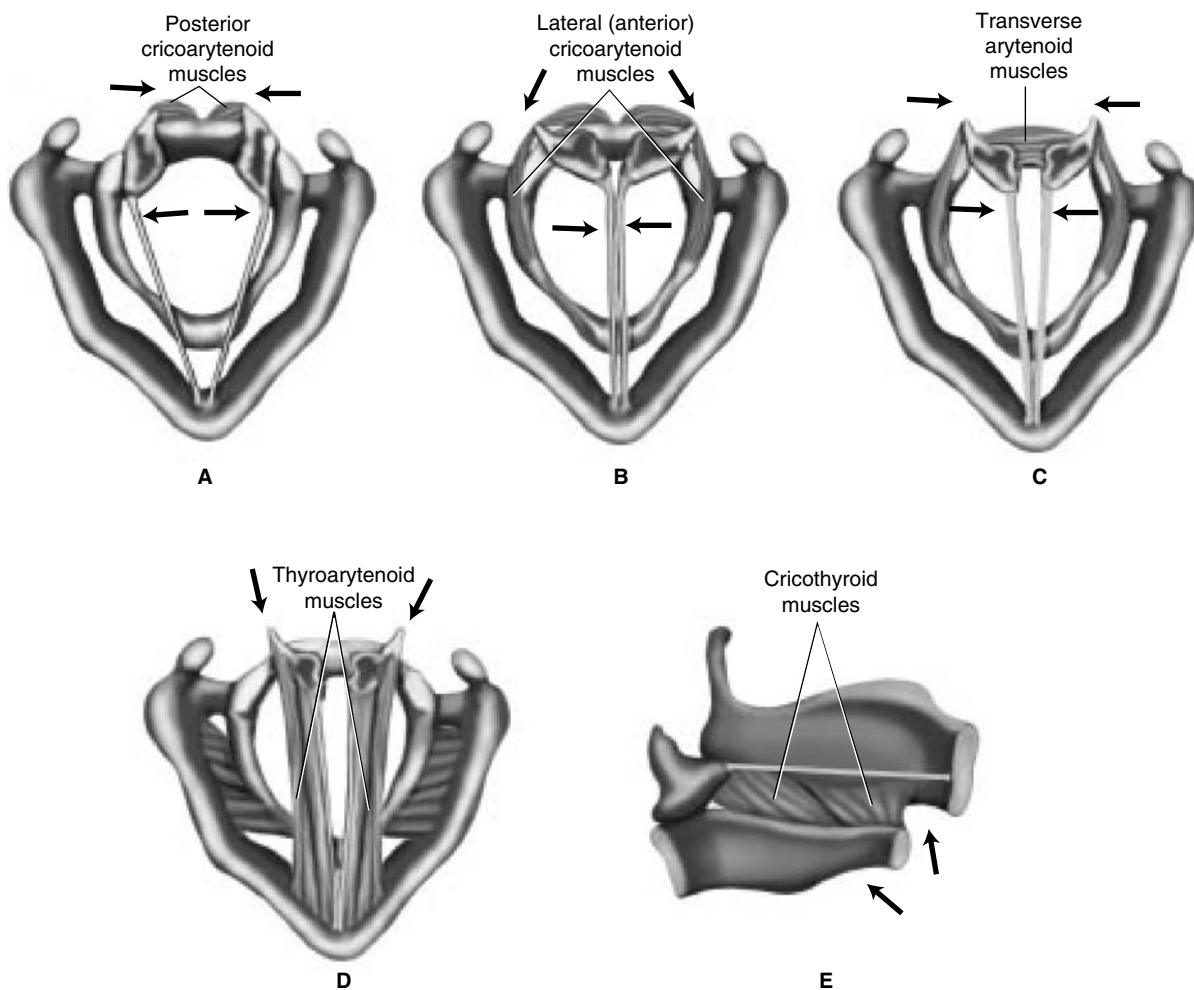
**Objective 10**

1. Label the following *extrinsic* laryngeal muscles:



**Figure 1-7** *Extrinsic laryngeal muscles.*

2. Label the following *intrinsic* laryngeal muscles:



**Figure 1-8** *Intrinsic laryngeal muscles.*

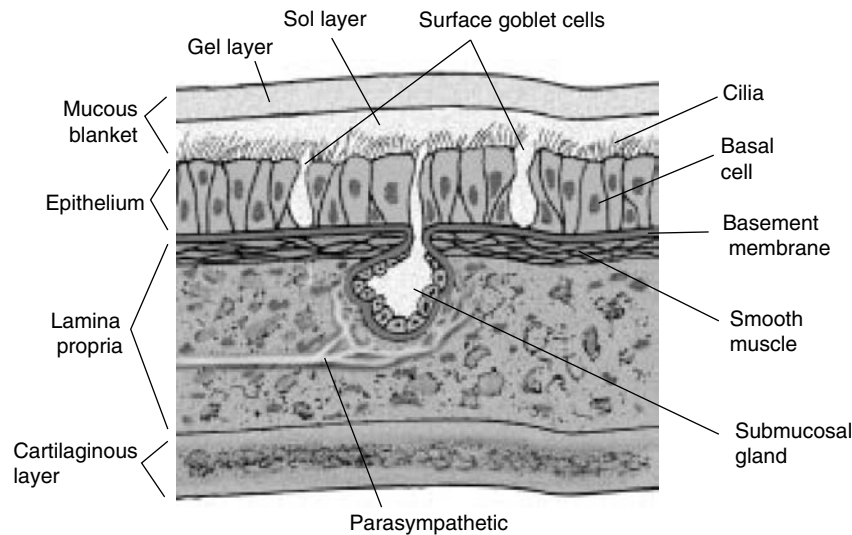
### Objective 11

1. During a quiet inspiration, the vocal folds:  
C. I and IV only
2. During exhalation, the vocal folds:  
D. II and III only



**Objective 12**

1. Label the following components of the epithelial lining of the tracheobronchial tree:



**Figure 1-9** *Epithelial lining of the tracheobronchial tree.*

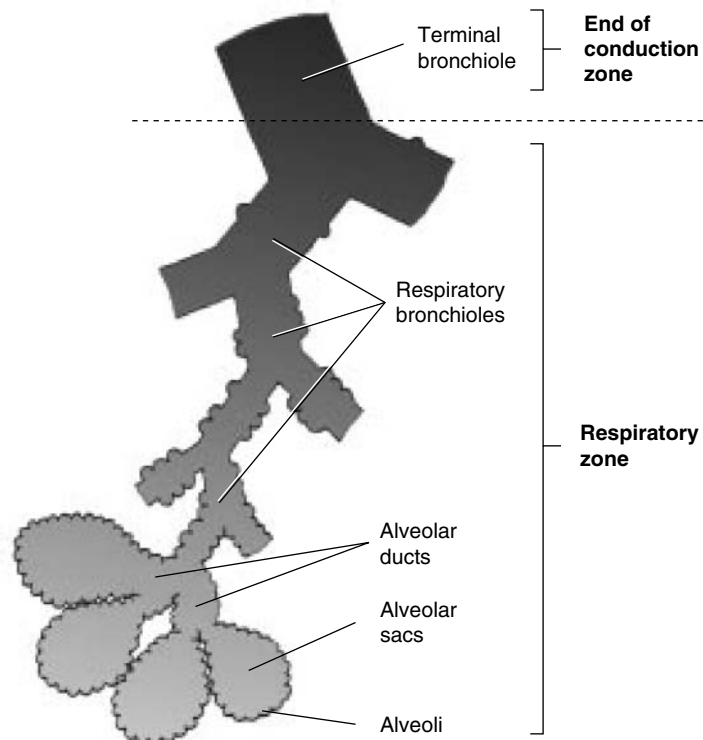
2. The epithelial lining of the tracheobronchial tree is primarily composed of:  
C. pseudostratified ciliated, columnar epithelium
3. The layer of mucus closest to the epithelium in the tracheobronchial tree is called the:  
A. sol layer
4. In the tracheobronchial tree, the mast cells are found in the:  
C. II and IV only
5. Most of the mucus that lines the lumen of the tracheobronchial tree is produced by the:  
D. II and IV only
6. Lymph vessels and nerves are found in which of the following structures of the trachea?  
B. lamina propria

**Objective 13**

1. The length of the trachea is about:  
B. 11–13 cm long
2. Which of the following is called the third generation of the tracheobronchial tree?  
A. segmental bronchi
3. The trachea is considered what generation of the tracheobronchial tree?  
A. 0 (zero) generation
4. Which of the following represents a correct sequence (from the mouth to the alveoli) of the tracheobronchial tree?  
C. bronchioles, terminal bronchioles, respiratory bronchioles, and alveoli ducts

**Objective 14**

- Using the following schematic drawing, label the anatomic structures distal to the terminal bronchioles:



**Figure 1–10** Schematic drawing of the anatomic structures distal to the terminal bronchioles; collectively, these are referred to as the primary lobule.

- Cartilage is absent in which of the following structures of the tracheobronchial tree?  
D. I, II, and IV only
- Terminal bronchioles permit gas to enter into adjacent alveoli via the:  
A. channels of Lambert

**Objective 15**

- Which of the following has the smallest cross-sectional area?  
A. trachea

**Objective 16**

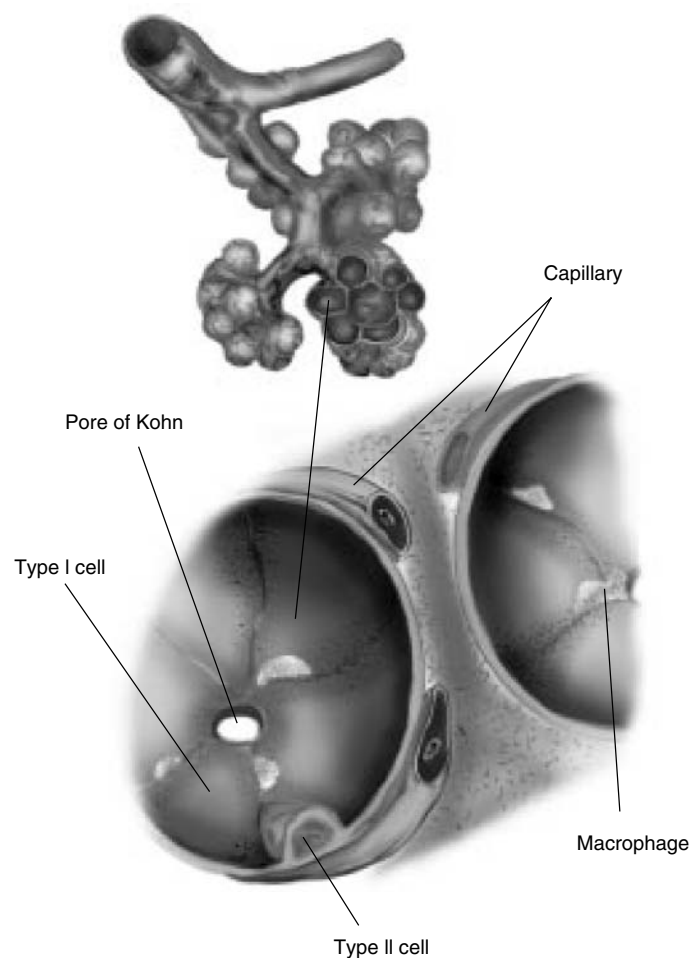
- Which of the following is/are nourished by the bronchial arteries?  
D. II, IV, and V only
- About one-third of the bronchial venous blood returns to the right atrium by way of the:  
D. I, III, and IV only

**Objective 17**

1. Ciliated cells disappear at which level of the tracheobronchial tree?  
C. respiratory bronchioles
2. What is the function of the primary lobule?  
D. gas exchange

**Objective 18**

1. About what percent of the total alveolar surface is composed of the Type I cells?  
D. 95%
2. The average diameter of the lung's alveoli ranges between:  
C. 75–300  $\mu$
3. The average surface area available for gas exchange is about:  
C. 70 square meters
4. Small holes in the walls of the interalveolar septa are called:  
B. pores of Kohn
5. Label the following components of the alveolar-capillary network:



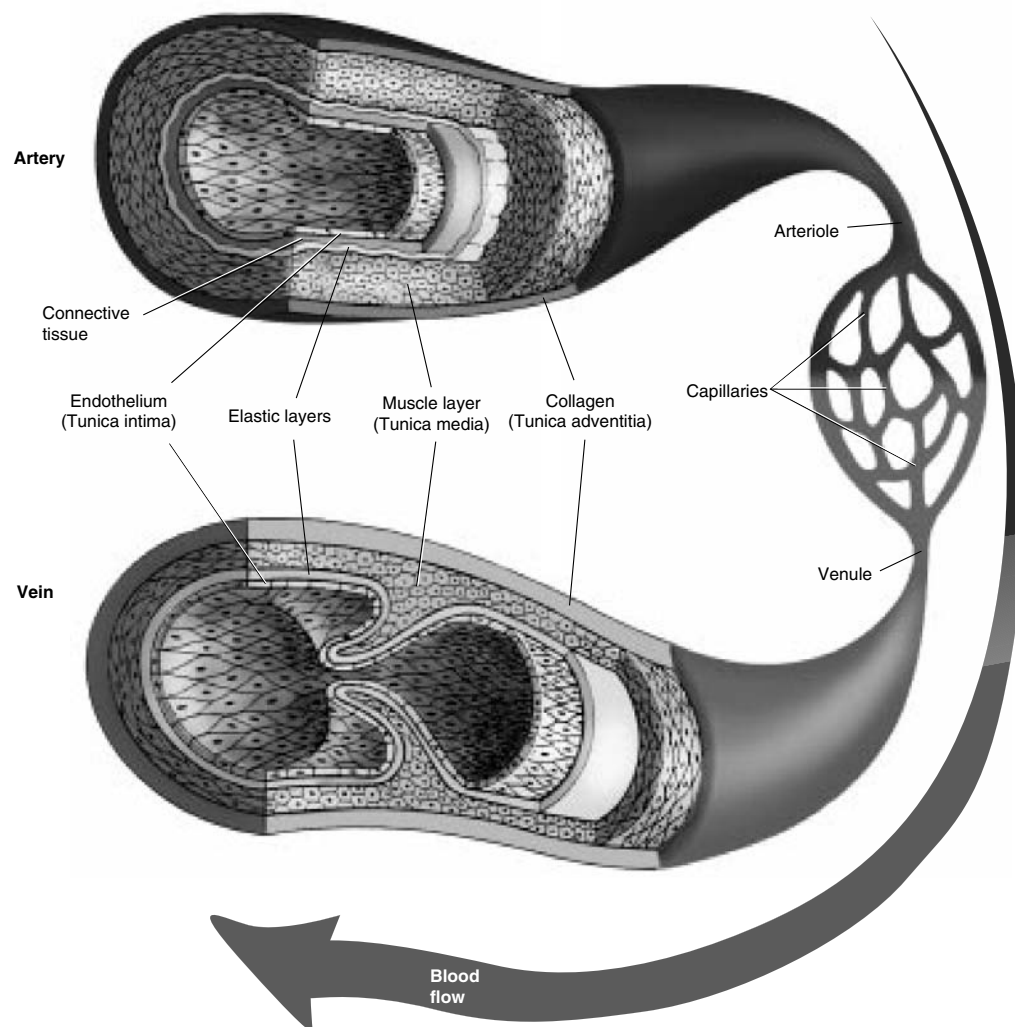
**Figure 1-11** *Alveolar-capillary network.*

**Objective 19**

1. The alveolar-capillary clusters are surrounded, supported, and shaped by the:  
C. interstitium
2. The interstitium is a space between the:  
B. alveoli and capillaries

**Objective 20**

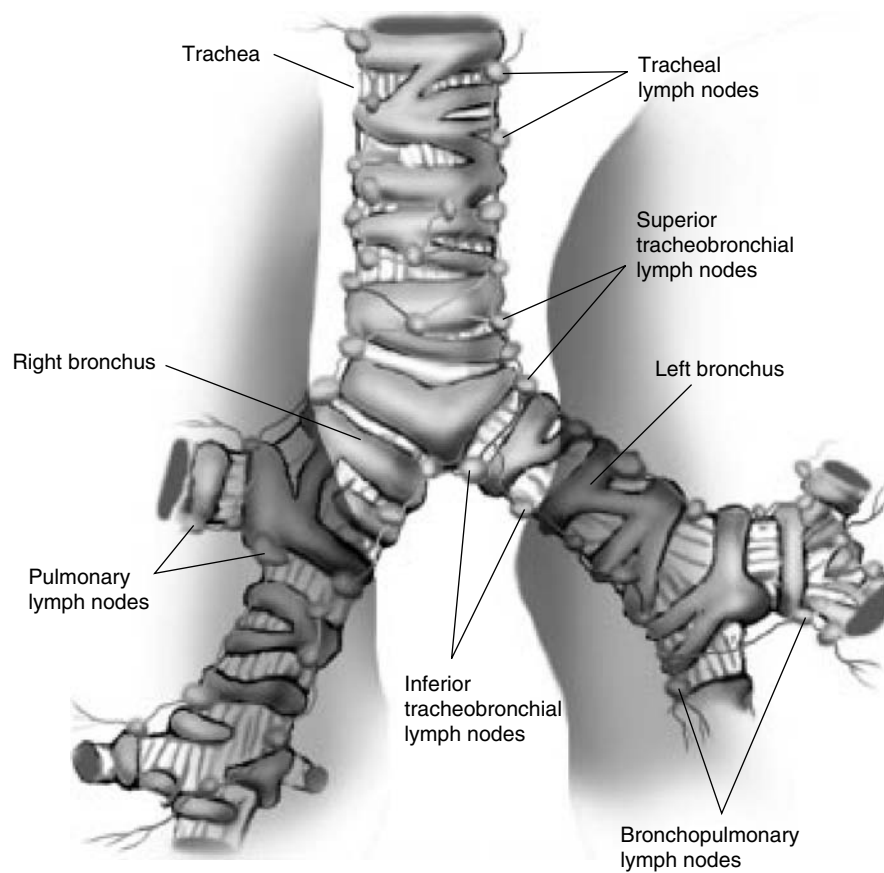
1. The external diameter of the pulmonary capillaries is about:  
A.  $10\ \mu$
2. Which of the following are called capacitance vessels?  
D. veins
3. Using the following schematic drawing, label the components of the major blood vessels:



**Figure 1-12** Schematic drawing of the components of the pulmonary blood vessels.

**Objective 21**

1. Label the following lymph nodes associated with the trachea and the right and left main stem bronchi:



**Figure 1-13** *Lymph nodes associated with the trachea and the right and left main stem bronchi.*

2. Lymphatic vessels:
  - D. I, II, III, and IV
3. What function do the lymphatic vessels in the lung perform?
  - A. fluid removal

**Objective 22**

1. Which of the following is/are associated with the sympathetic nervous system?  
D. I, II, III, and IV

**Objective 23**

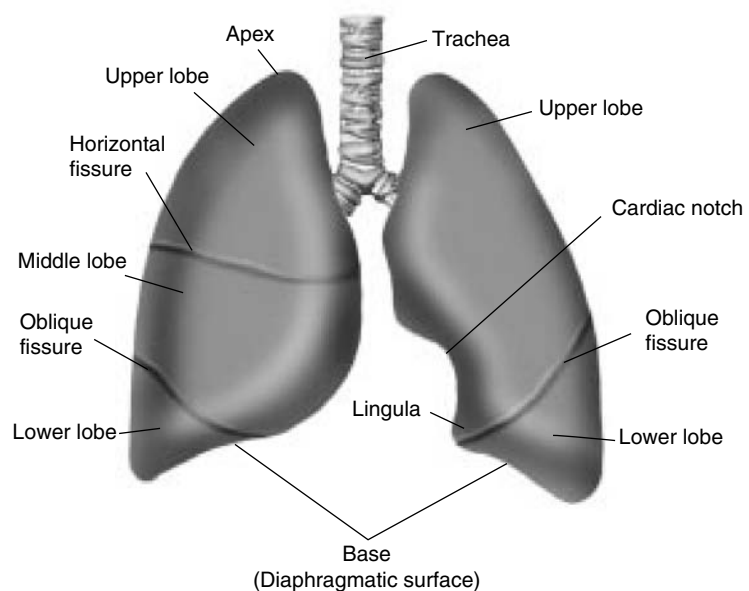
1. Compare and contrast the effects of the sympathetic and parasympathetic nervous system on the effector sites identified below:

**Some Effects of Autonomic Nervous System Activity**

EFFECTOR SITE	SYMPATHETIC NERVOUS SYSTEM	PARASYMPATHETIC NERVOUS SYSTEM
Heart	Increases rate Increases strength of contraction	Decreases rate Decreases strength of contraction
Bronchial smooth muscle	Relaxation	Constriction
Bronchial glands	Decreases secretions	Increases secretions
Salivary glands	Decreases secretions	Increases secretions
Stomach	Decreases motility	Increases motility
Intestines	Decreases motility	Increases motility
Eye	Widens pupils	Constricts pupils

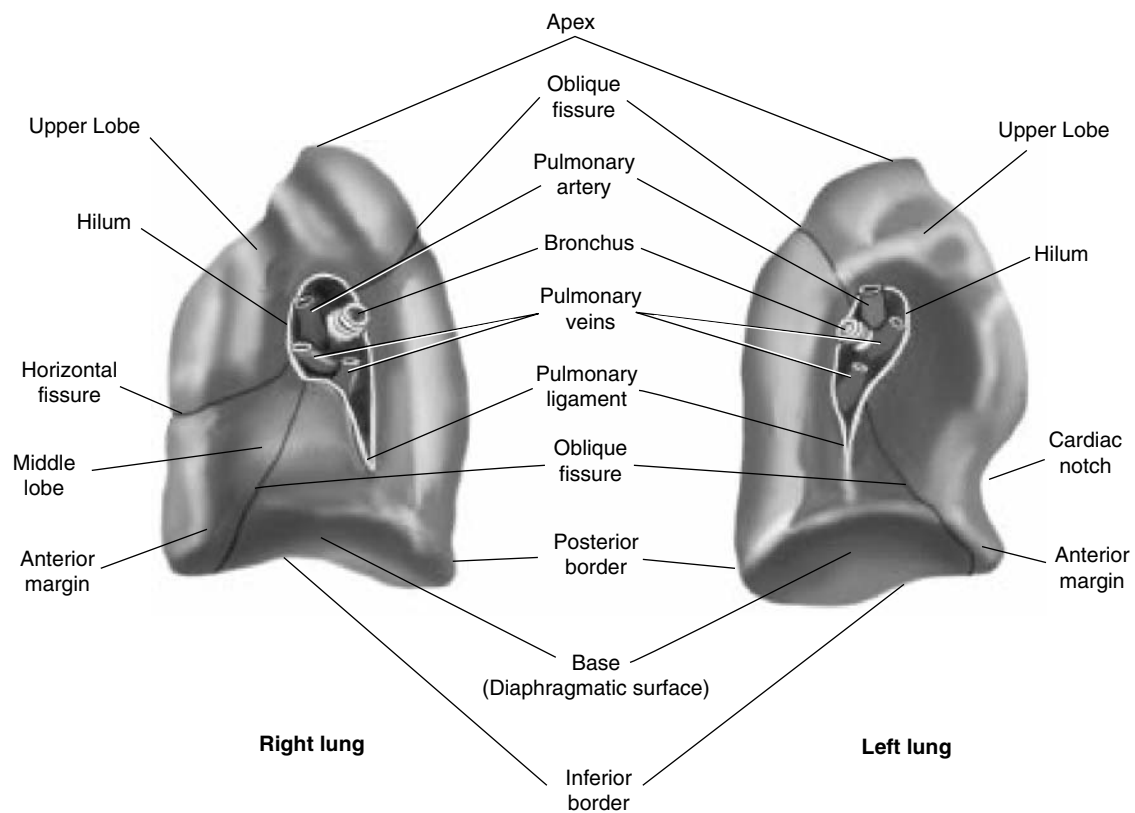
**Objective 24**

1. The right and left main stem bronchi, blood vessels, and nerves enter and exit lungs through the:  
D. hilum
2. Anteriorly, the base of the lungs extend to about the level of which of the following ribs?  
B. 6th rib
3. Posteriorly, the base of the lungs extend to about the level of which of the following ribs?  
D. 11th rib
4. Label the following structures of the anterior portion of the lungs:



**Figure 1-14** *Anterior view of the lungs.*

5. Label the following structures of the medial portion of the lungs:



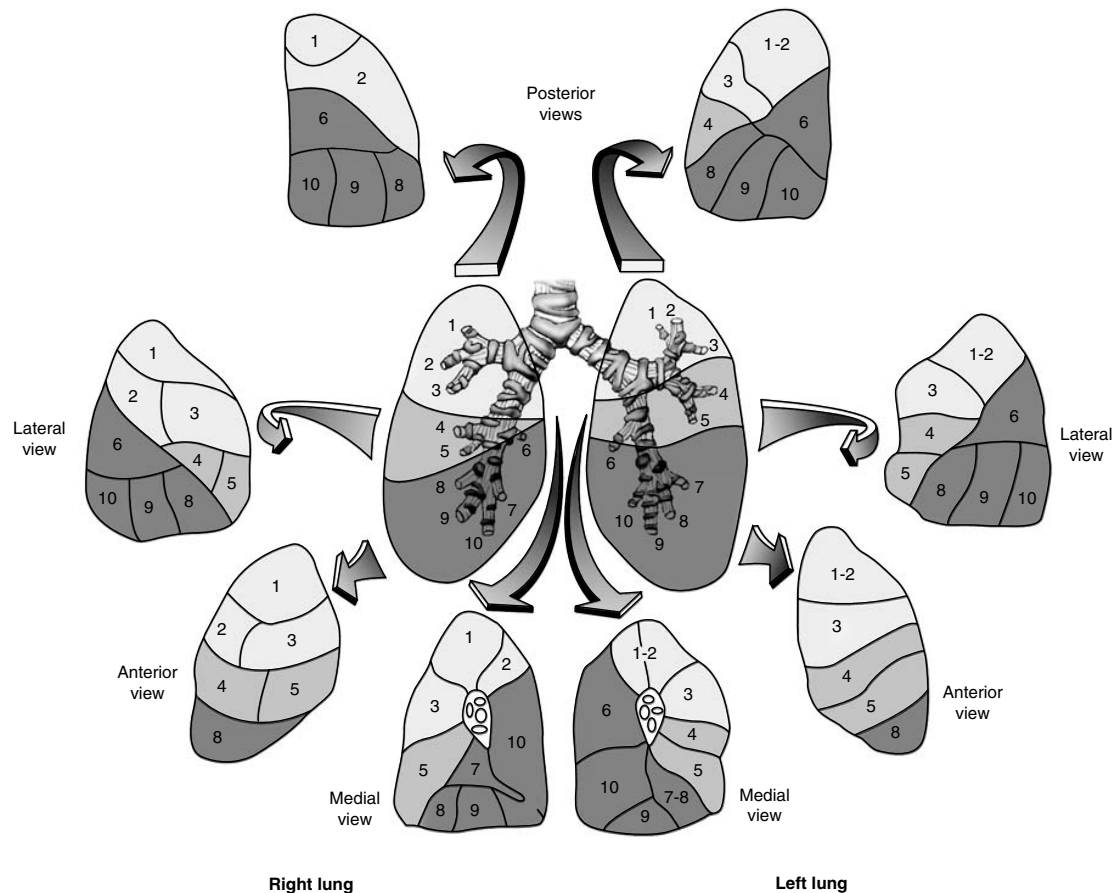
**Figure 1-15** Medial view of the lungs.



## Objective 25

- The inferior lingula lung segment is found in the:  
D. left lung, lower division of upper lobe
- Match the number of the lung segments shown in the box to the different views of the lungs shown as shaded sections below:

Right lung		Left lung	
Upper lobe		Upper lobe	
Apical	1	Upper division	
Posterior	2	Apical/Posterior	1 & 2
Anterior	3	Anterior	3
Middle lobe		Lower division (lingular)	
Lateral	4	Superior lingula	4
Medial	5	Inferior lingula	5
Lower lobe		Lower lobe	
Superior	6	Superior	6
Medial basal	7	Anterior medial basal	7 & 8
Anterior basal	8	Lateral basal	9
Lateral basal	9	Posterior basal	10
Posterior basal	10		



**Figure 1-16** Lung segments. Although the segment subdivisions of the right and left lungs are similar, there are some slight anatomic differences, which are noted by combined names and numbers. Because of these slight variations, some workers consider that, technically, there are only eight segments in the left lung and that the apical-posterior segment is number 1 and the anteromedial is number 6.

**Objective 26**

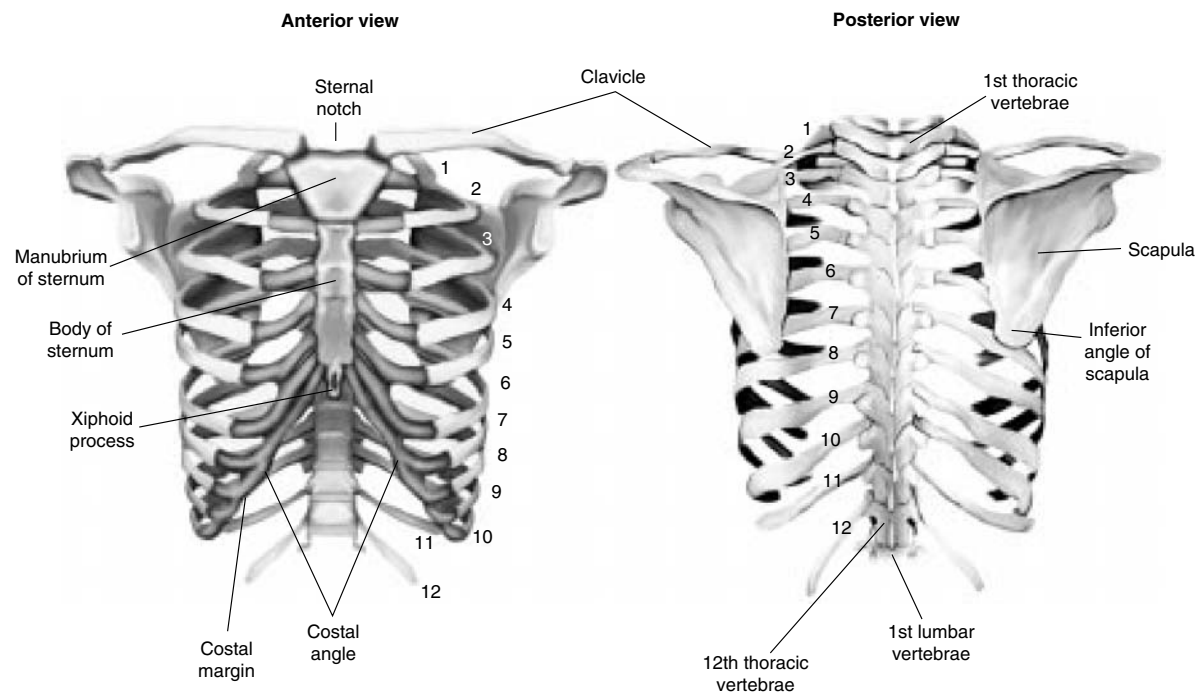
1. The mediastinum contains which of the following?  
D. I, II, III, and IV

**Objective 27**

1. The parietal pleura lines the:  
D. thorax
2. Which of the following lines the inside of the thoracic wall?  
B. parietal pleurae

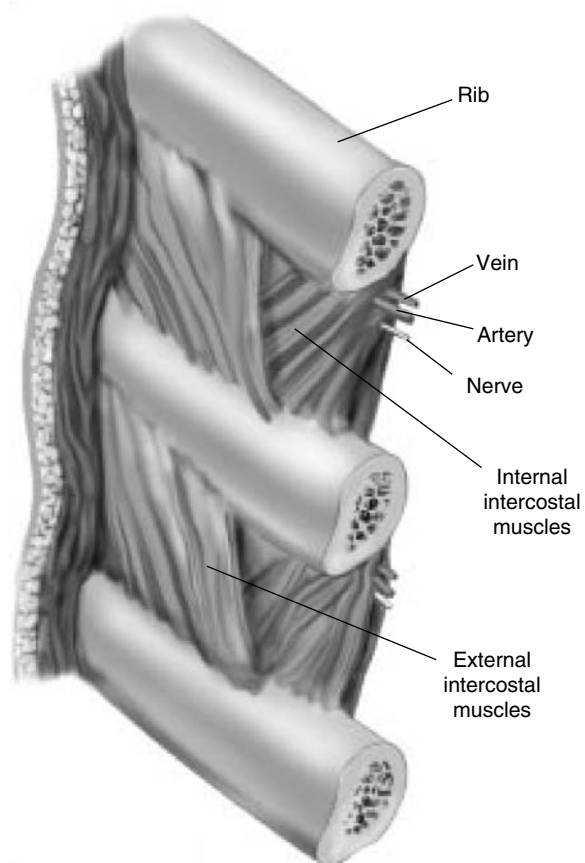
**Objective 28**

1. Which of the following are part of the sternum?  
D. II and IV only
2. Ribs eight, nine, and ten are referred to as the:  
C. false ribs
3. Label the following components of the thorax:



**Figure 1-17** *The thorax.*

4. Label the following components of the intercostal space:



**Figure 1-18** *The intercostal space.*

### **Objective 29**

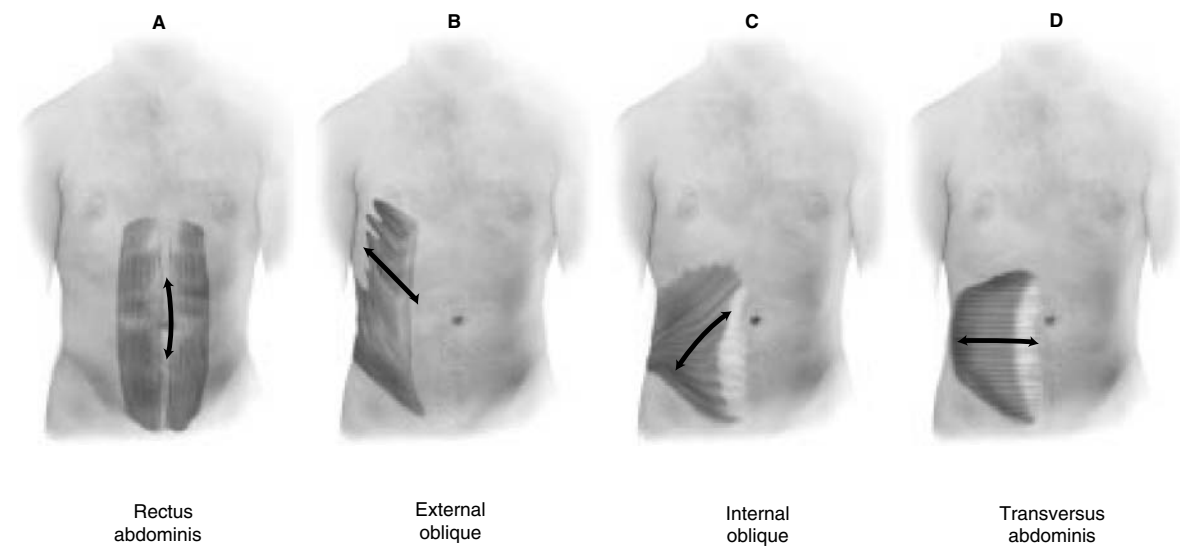
1. The primary motor innervation of each hemidiaphragm is supplied by the:  
B. II only

### **Objective 30**

1. When used as accessory muscles of inspiration, the scalene muscles elevate the following ribs:  
C. I and II only
2. During inspiration, the external intercostal muscles cause the ribs to move:  
D. I and IV only

**Objective 31**

1. During the expiration, the internal intercostal muscles cause the ribs to move:  
C. II and III only
2. Label the following accessory muscles of expiration:



**Figure 1-19** *Accessory muscles of expiration.*

**Objectives 30 and 31—matching exercise:**

Muscles of inspiration: b, e, i, l, m

Muscles of expiration: a, c, f, g, k