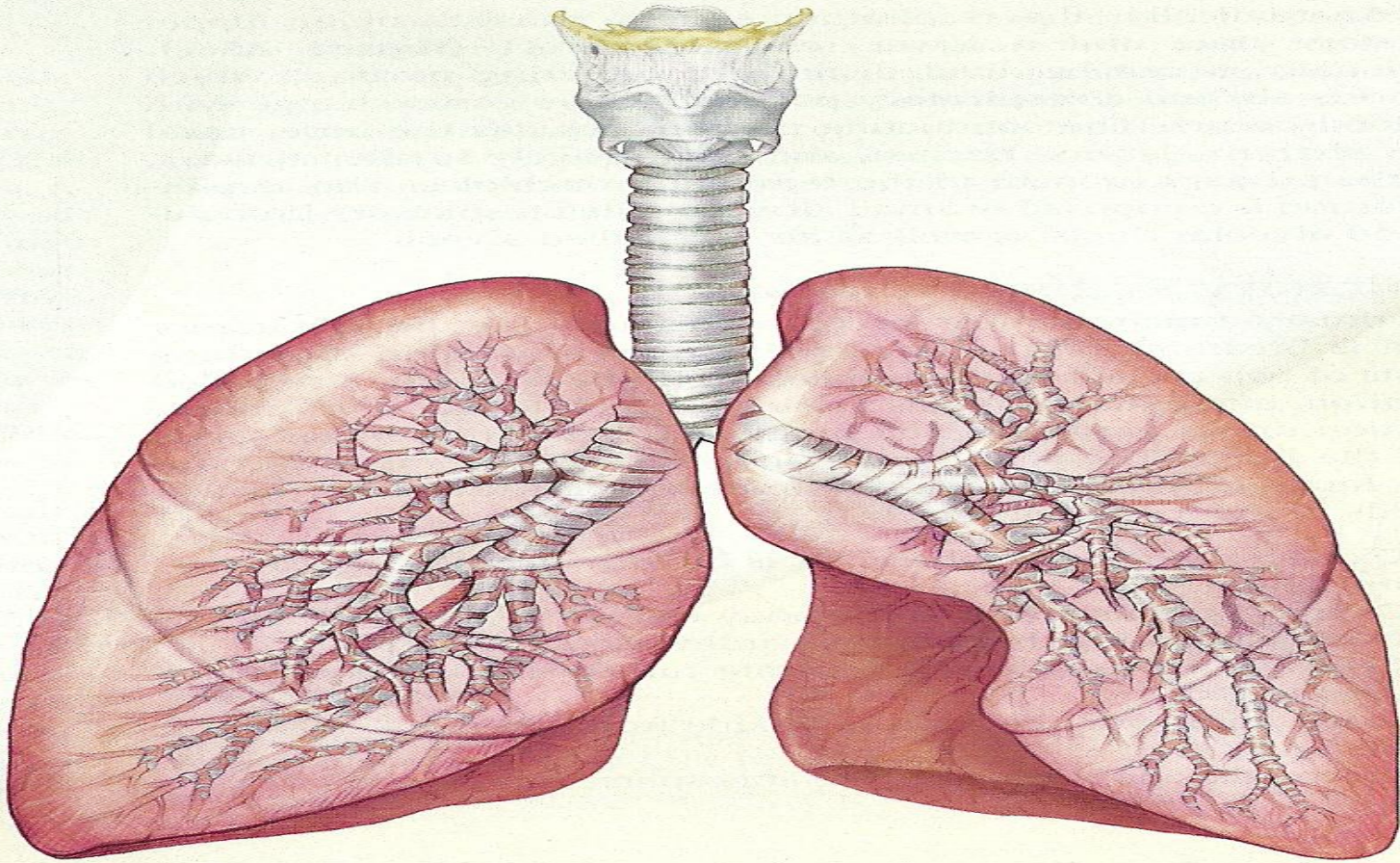


# Anatomy of Respiratory System

781



**This system is responsible for bringing O<sub>2</sub> into the body and getting rid of carbon dioxide (CO<sub>2</sub>) from the body.**

- **The air enters the body from the nostrils then passes through the nasal cavity to the pharynx, larynx, trachea, bronchi, bronchioles, then to the alveoli in the lungs.**

- **Respiratory epithelium: Respiratory tract lined with ciliated pseudostratified columnar epithelium that contains a rich population**

# UPPER RESPIRATORY SYSTEM

```
graph TD; A[UPPER RESPIRATORY SYSTEM] --> B[Paranasal Sinuses (Air Filled Cavities)]; A --> C[NASAL CAVITY]
```

**Paranasal Sinuses  
(Air Filled Cavities)**

**NASAL CAVITY**

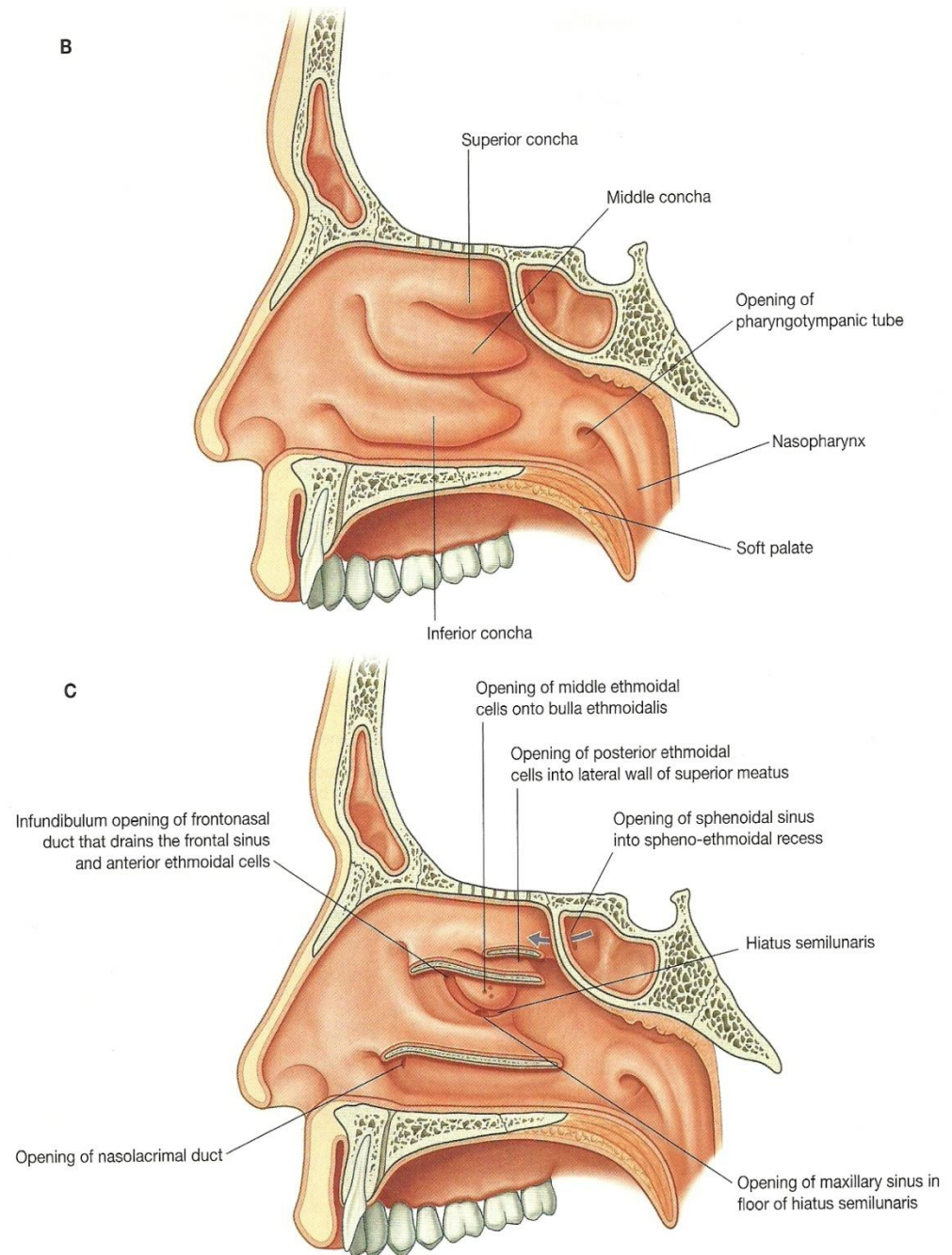
# The Nasal Cavity

The nasal cavity is divided into two chambers by a nasal septum,

- The nasal septum forms the medial wall of the nasal chamber.
- The anterior part of the nasal septum is composed of cartilage, and the posterior part is composed of bone.
- The lateral wall of the nasal cavity contains three prominent elevations called conchae (superior concha, middle concha, and inferior concha). Therefore, three air meatuses are formed for air passage; these are the inferior, middle, and superior meatuses.
- The inferior and middle conchae are lined by respiratory epithelium.
- The superior concha is covered with specialized olfactory epithelium (for smell = olfaction).
- Olfactory epithelium is a specialized area of mucous membrane in the superior concha located in the roof of the nasal cavity.

## Structures of Nasal Cavity

1. Superior concha.
2. Middle concha.
3. Inferior concha.
4. Opening of pharyngotympanic tube.
5. Soft palate.
6. Nasopharynx.
7. Opening of nasolacrimal duct.
8. Opening of maxillary sinus.
9. Opening of sphenoid sinus.
10. Opening of frontal sinus.
11. Opening of anterior and posterior ethmoidal cell.



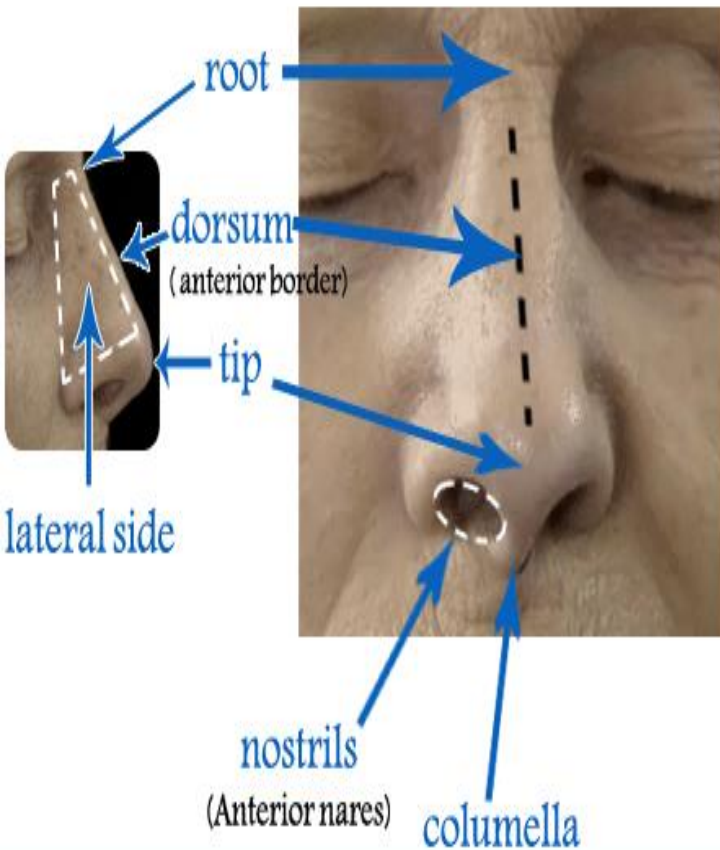
**Fig. 8.226, cont'd.** Lateral wall of the nasal cavity. **B.** Covered with mucosa. **C.** Conchae broken away at attachment to lateral wall.



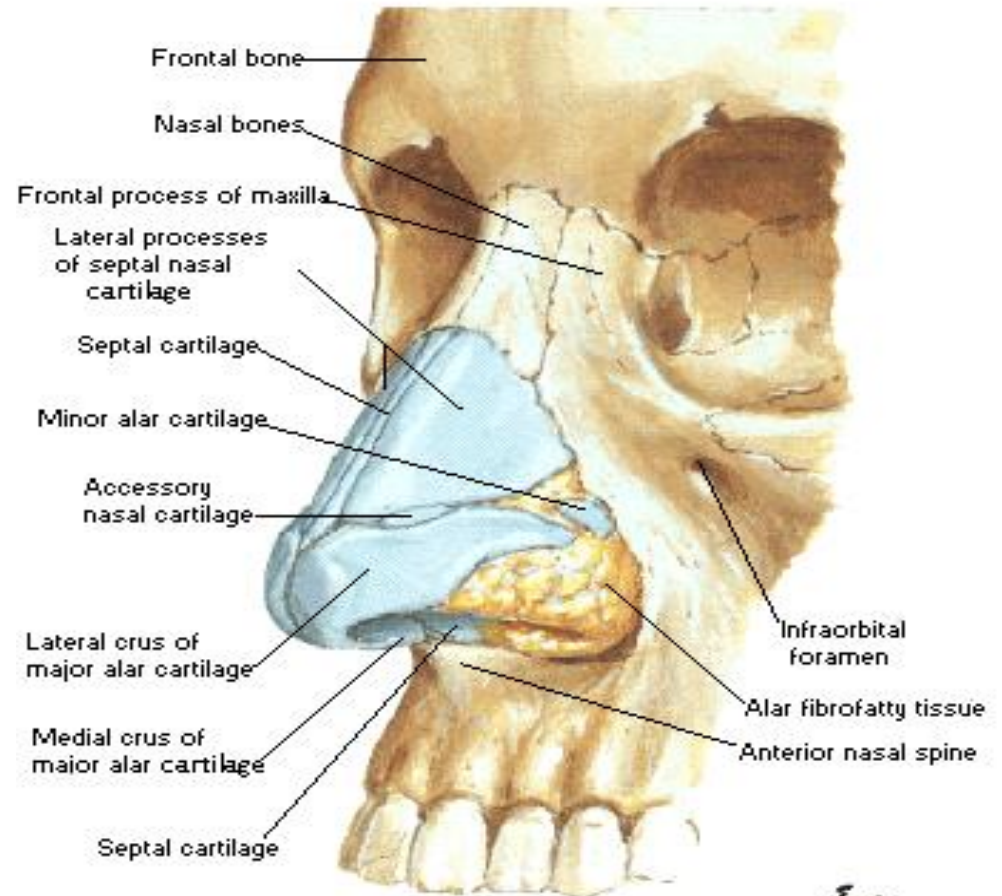
**The external nares (nastrils) are guarded by numerous sebaceous, and sweat glands and long hair to prevent large airborne particles like insect to get in.**

- The nasal cavity is lined by mucous membrane. The mucous membrane secretes serous fluid which moistened the inhaled air.**
- Nasal cavity rich in blood which warm the air**

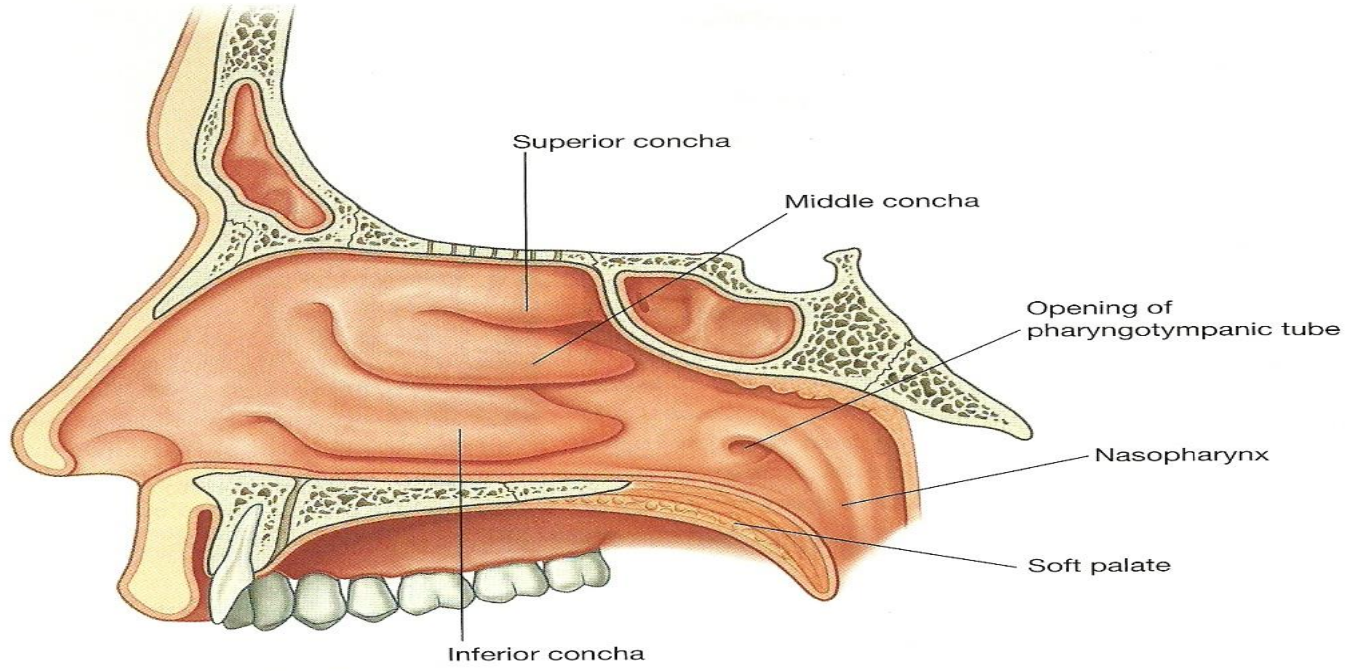
## External nose features



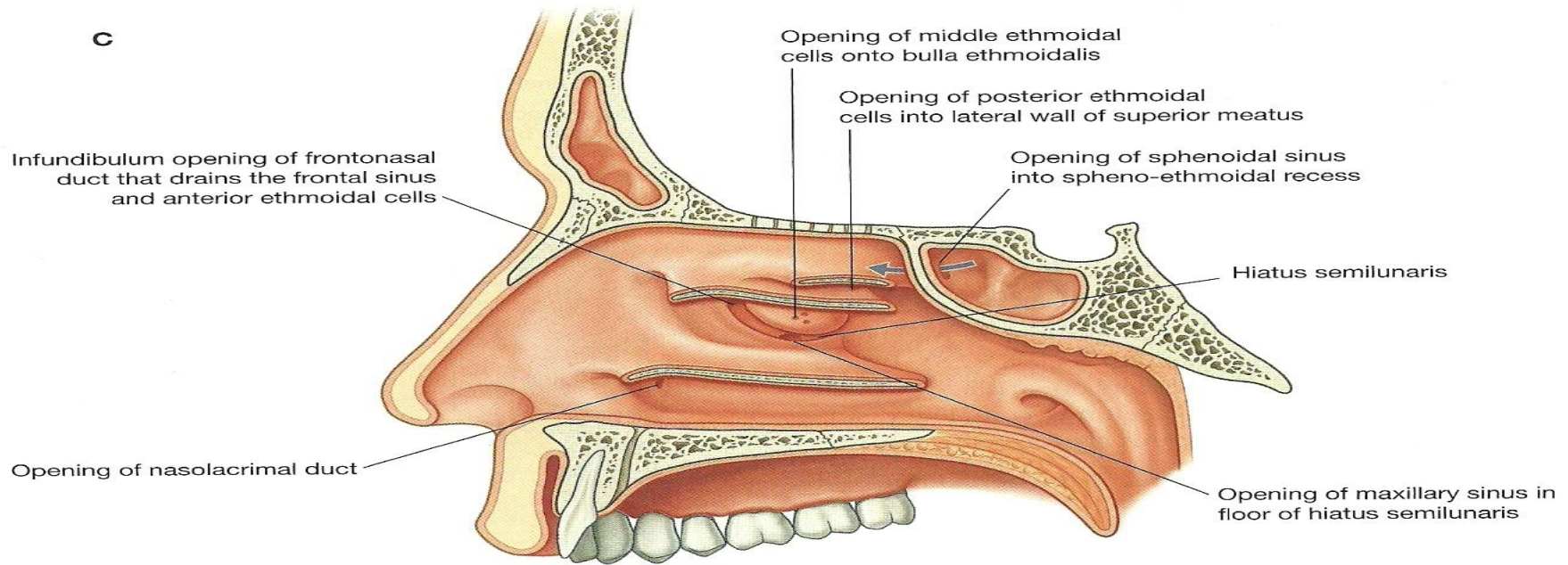
## Nose [Skeleton] Anterolateral View



**B**



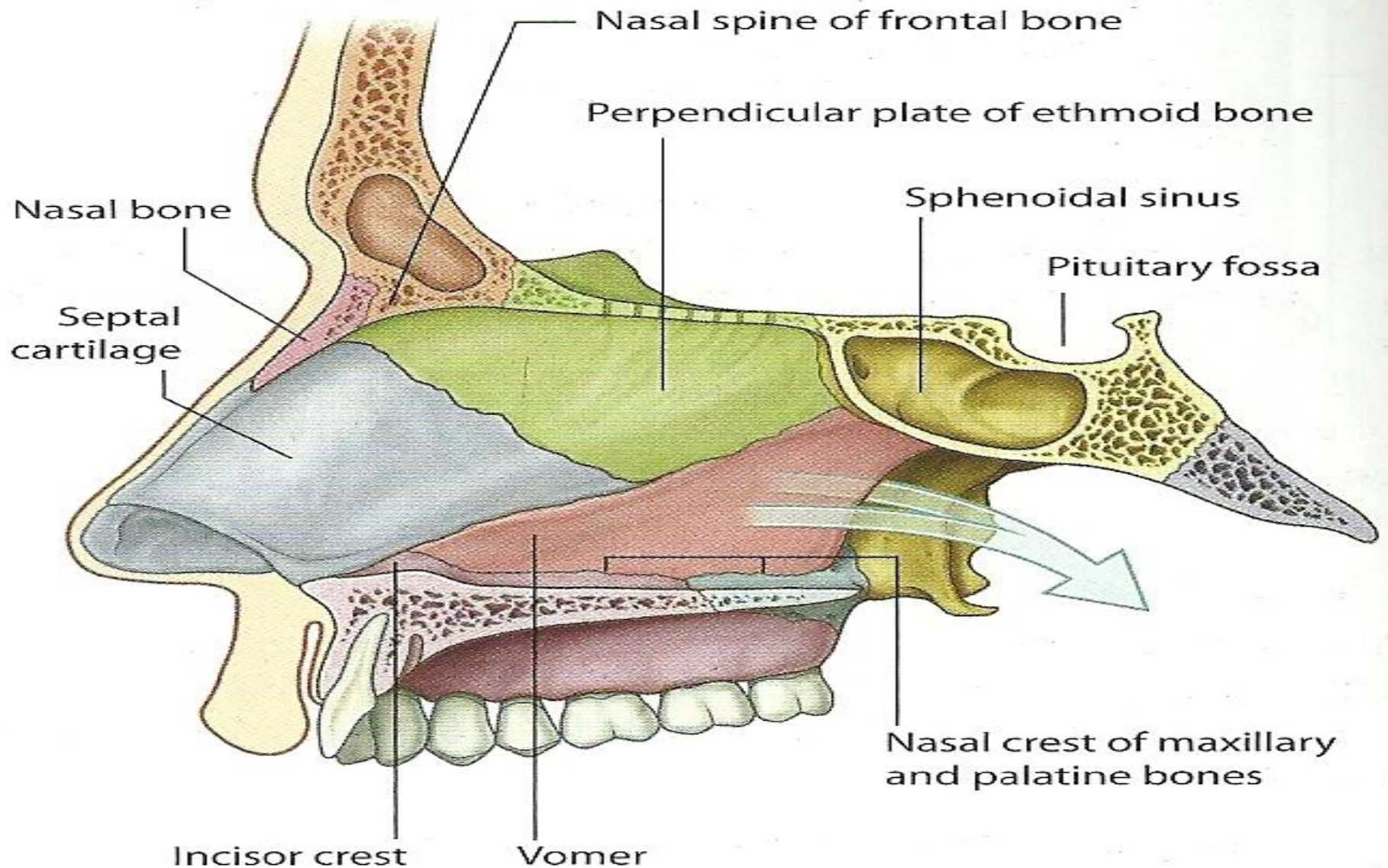
**C**



**Fig. 8.226, cont'd.** Lateral wall of the nasal cavity. **B.** Covered with mucosa. **C.** Conchae broken away at attachment to lateral wall.



## Medial Wall of Nasal Cavity – The Nasal Septum



# Functions of the Nose

form a resonating cavity for noise.

- It is an olfactory organ for sense of odor.

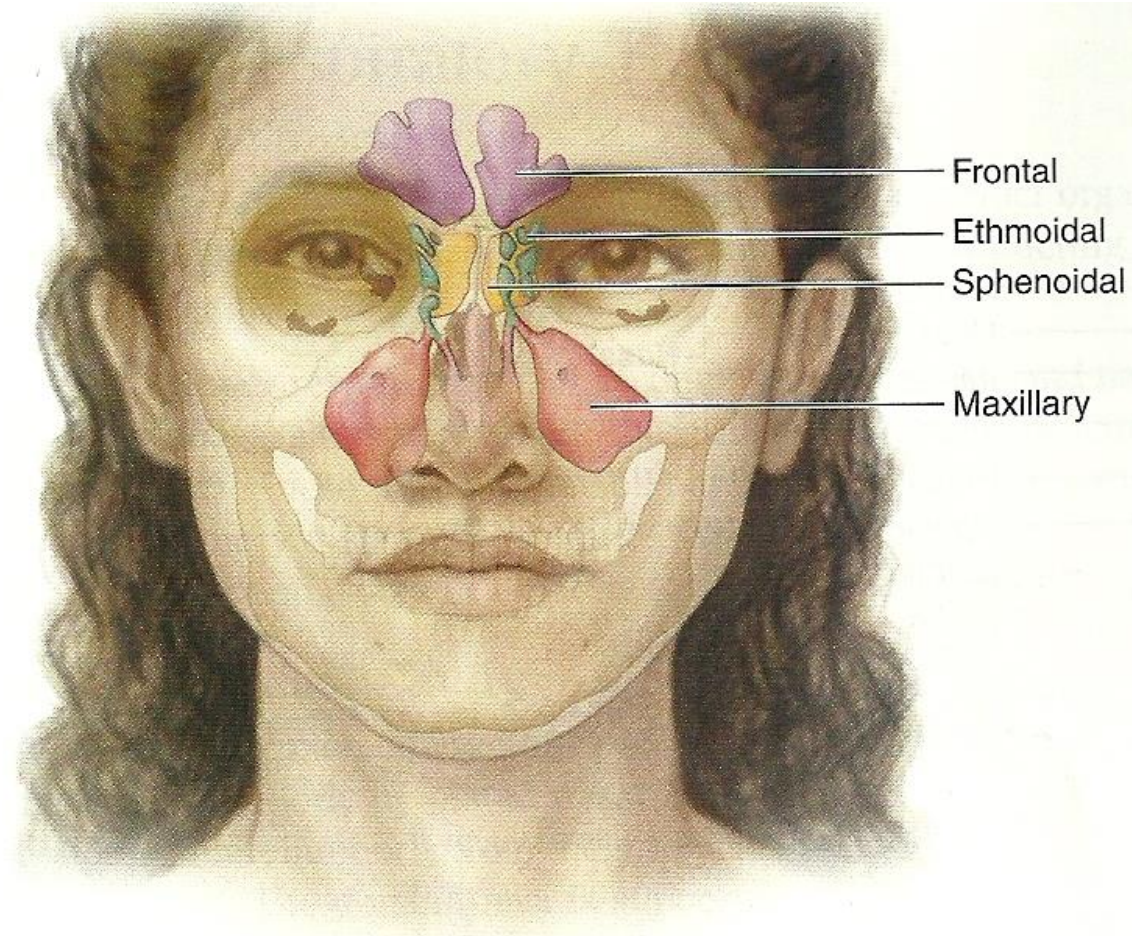
- It is a part of the respiratory system (its function is to filter,

warm and moisten the inhaled air before it reaches

the lungs

# Sinuses (Air Filled Cavities)

1. Frontal sinus.
2. Sphenoid sinus.
3. Maxillary sinus.
4. Ethmoid sinus

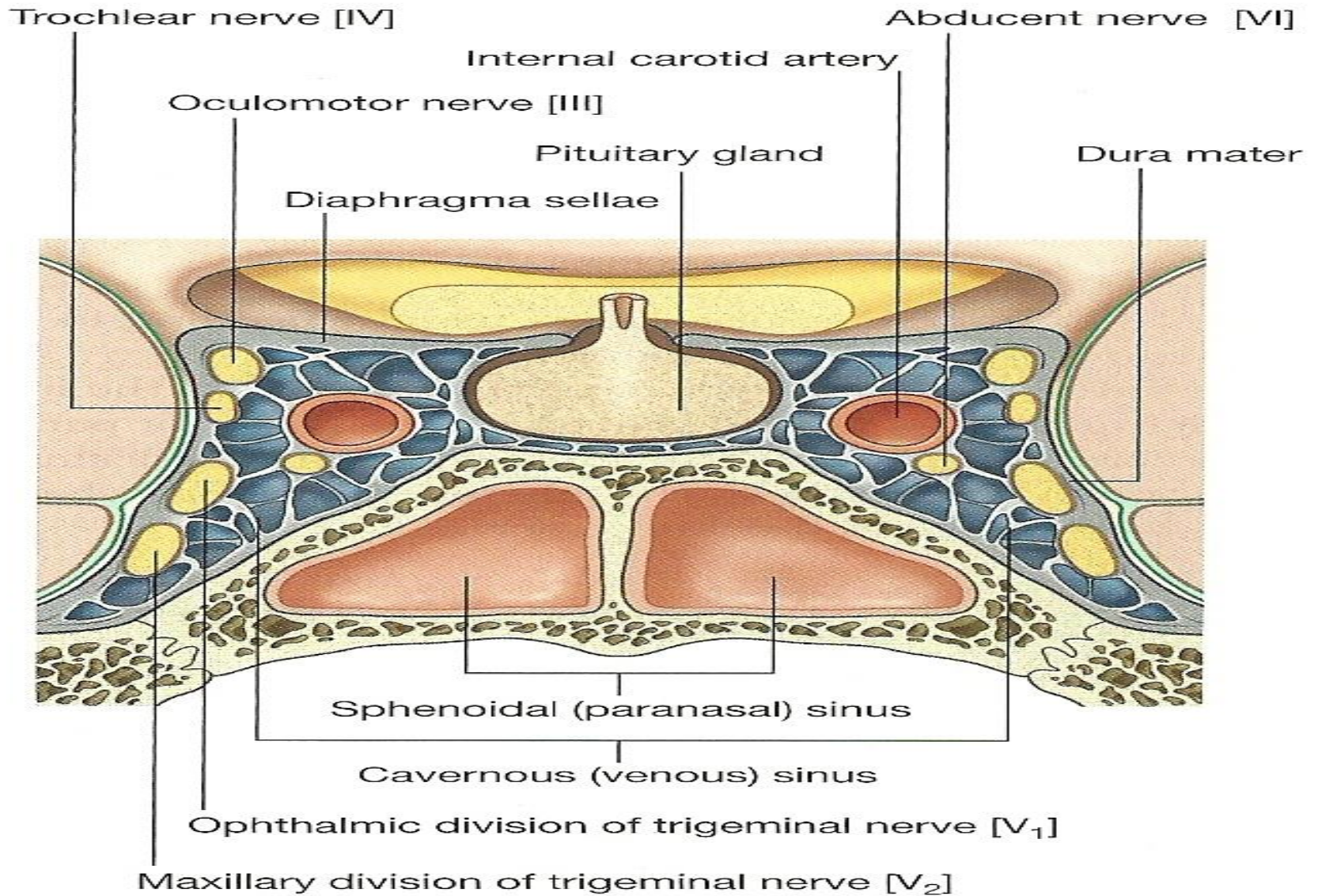


**Figure 25.3**

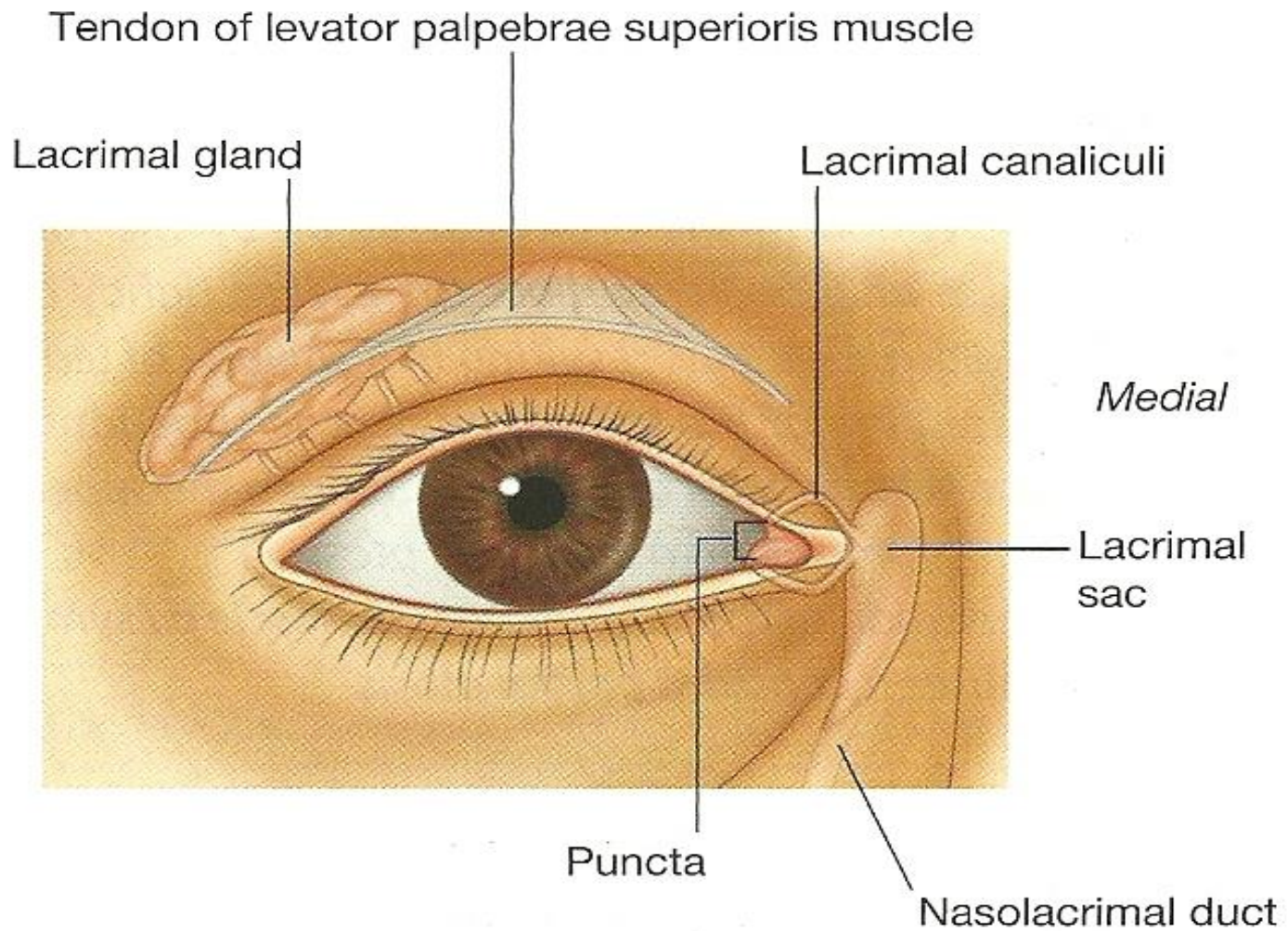
**Paranasal Sinuses.** The paranasal sinuses are air-filled cavities named for the bones in which they are found: frontal, ethmoidal, sphenoidal, and maxillary.



# Cavernous Sinus







**Fig. 8.77** Lacrimal gland, anterior view.

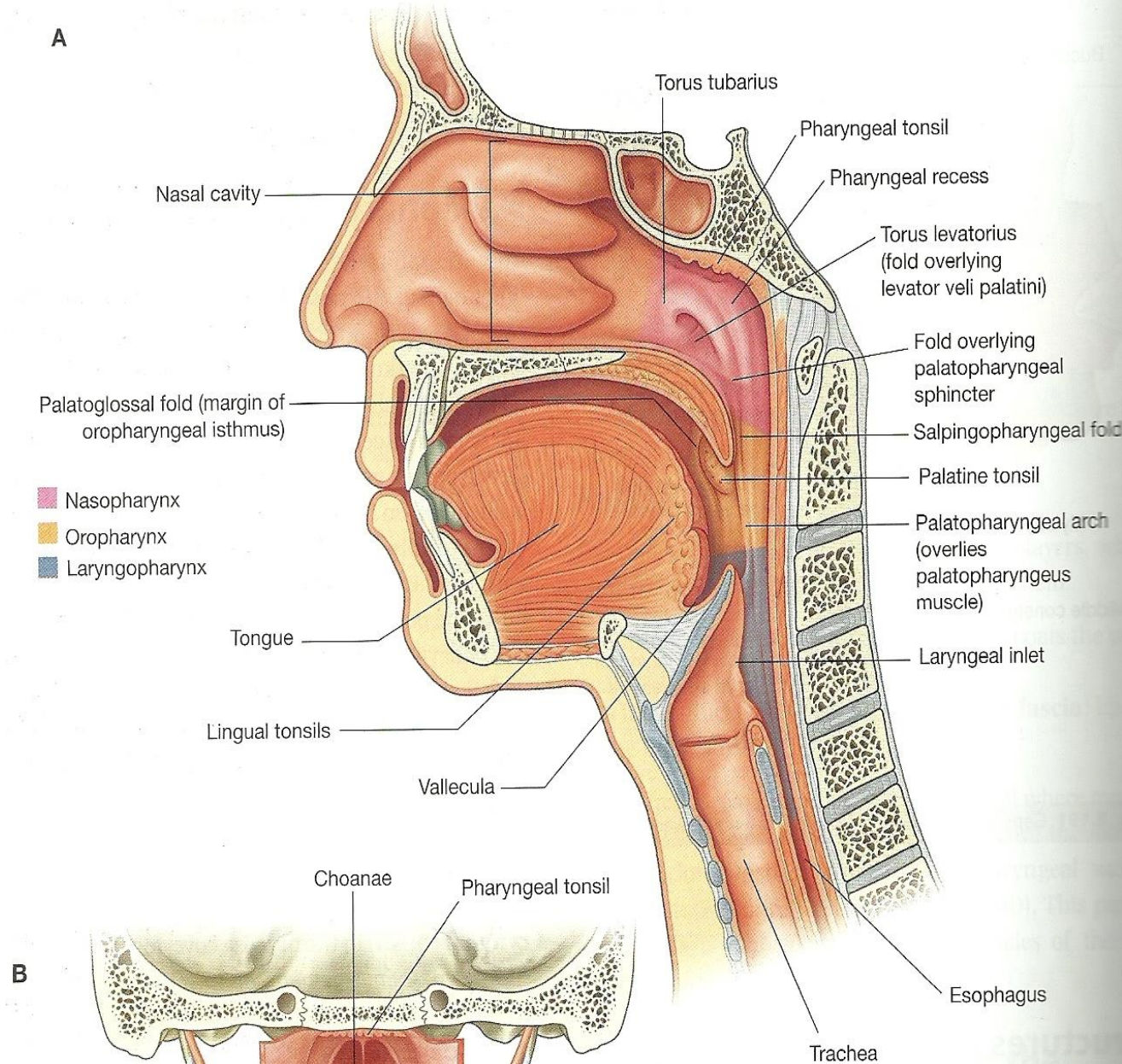
# Functions of Paranasal Sinuses

1. Humidify inhaled air.
2. Warming inhaled air.
3. Clean inhaled air.
4. Sound resonance.
5. Lighten weight of skull.

# PHARYNX AND LARYNX

## Structure of Pharynx

1. Nasopharynx.
2. Oropharynx.
3. Laryngeopharynx



# Functions of Pharynx

1. Air passage between nasal cavity and larynx.
2. Passage way for swallowed food and drink between oral cavity and esophagus



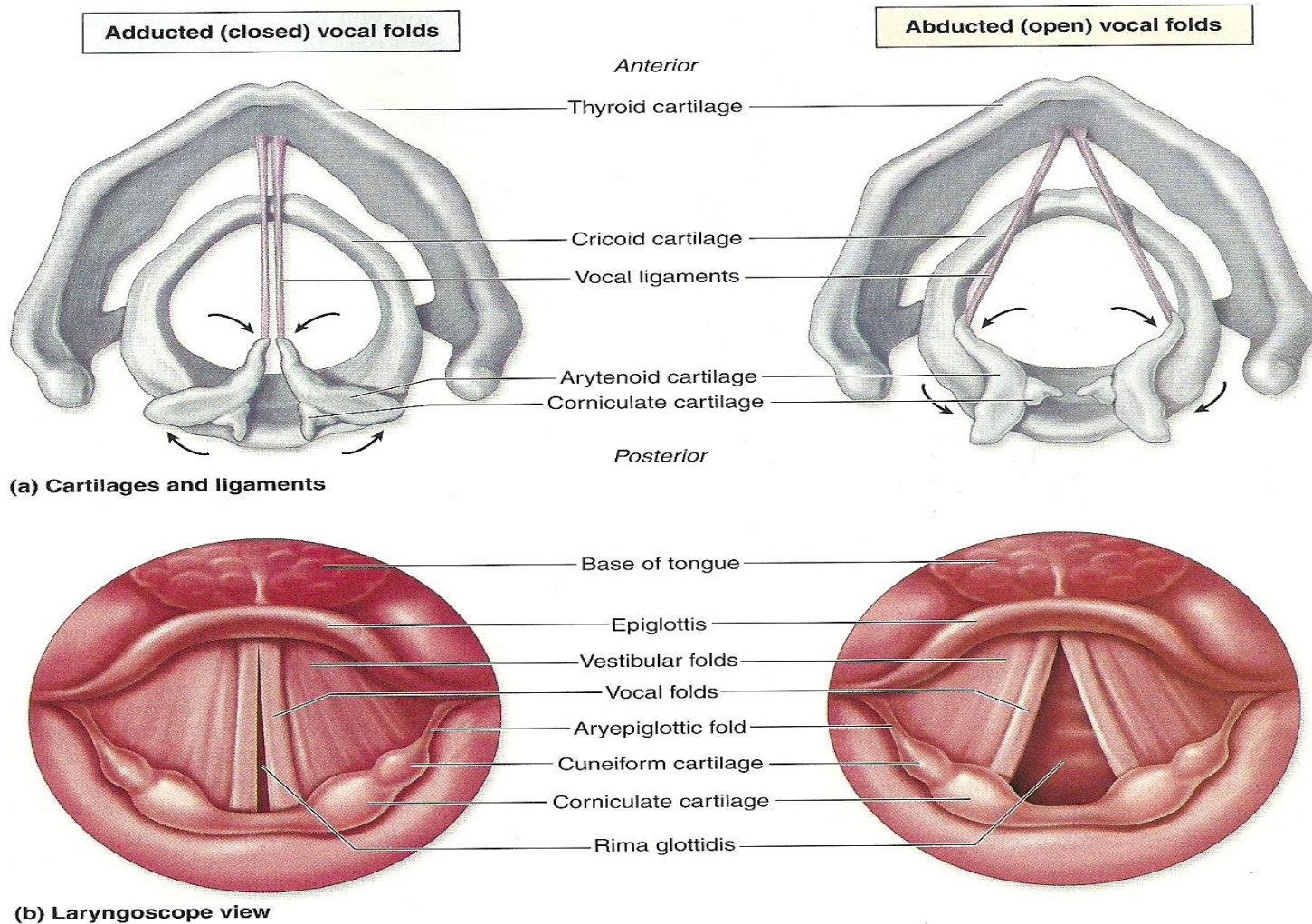
# Types of Structures in the Larynx (Voice Box

1. Cartilage-nine piece of cartilage supported by ligaments and muscles.
2. Skeletal muscle.
3. Ligaments.

# Structures of Larynx

1. Thyroid cartilage.
2. Cricoid cartilage.
3. Arytenoid cartilage.
4. Corniculate cartilage.
5. Epiglottis.
6. Hyoid bone.
7. Vestibular ligament.

# Larynx latera



**Figure 25.5**

**Vocal Folds.** The vocal folds (true vocal cords) are epithelium-covered elastic ligaments extending between the thyroid and arytenoid cartilages. These folds surround the rima glottidis and are involved in sound production. Adducted (closed) and abducted (open) vocal folds are shown in (a) a view of the cartilages and ligaments only and in (b) a diagrammatic laryngoscopic view of the coverings around these cartilages and ligaments.

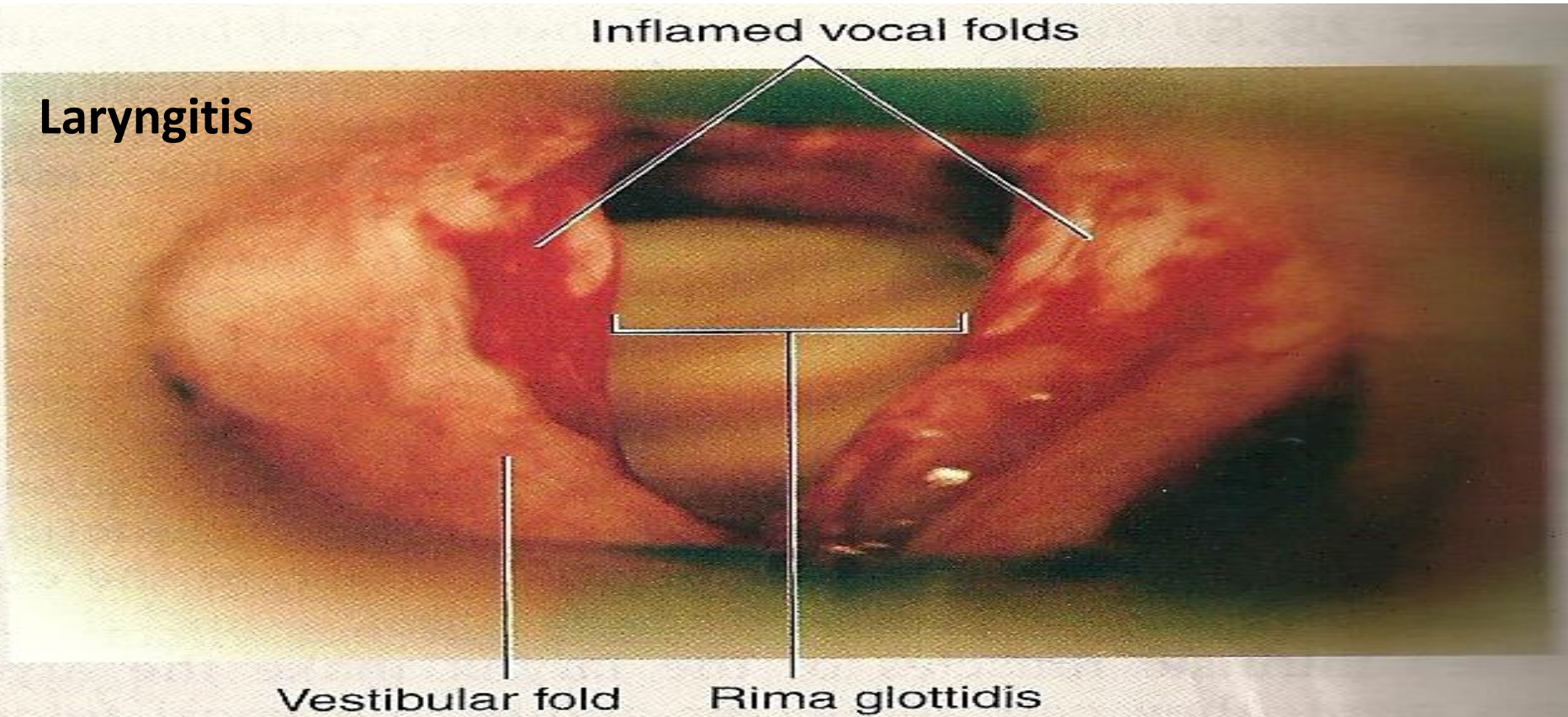
# Functions of Larynx

1. Prevents food and drink from entering trachea.
2. Conducts air.
3. Produces sound.



# Clinical Disorder of Larynx

Laryngitis



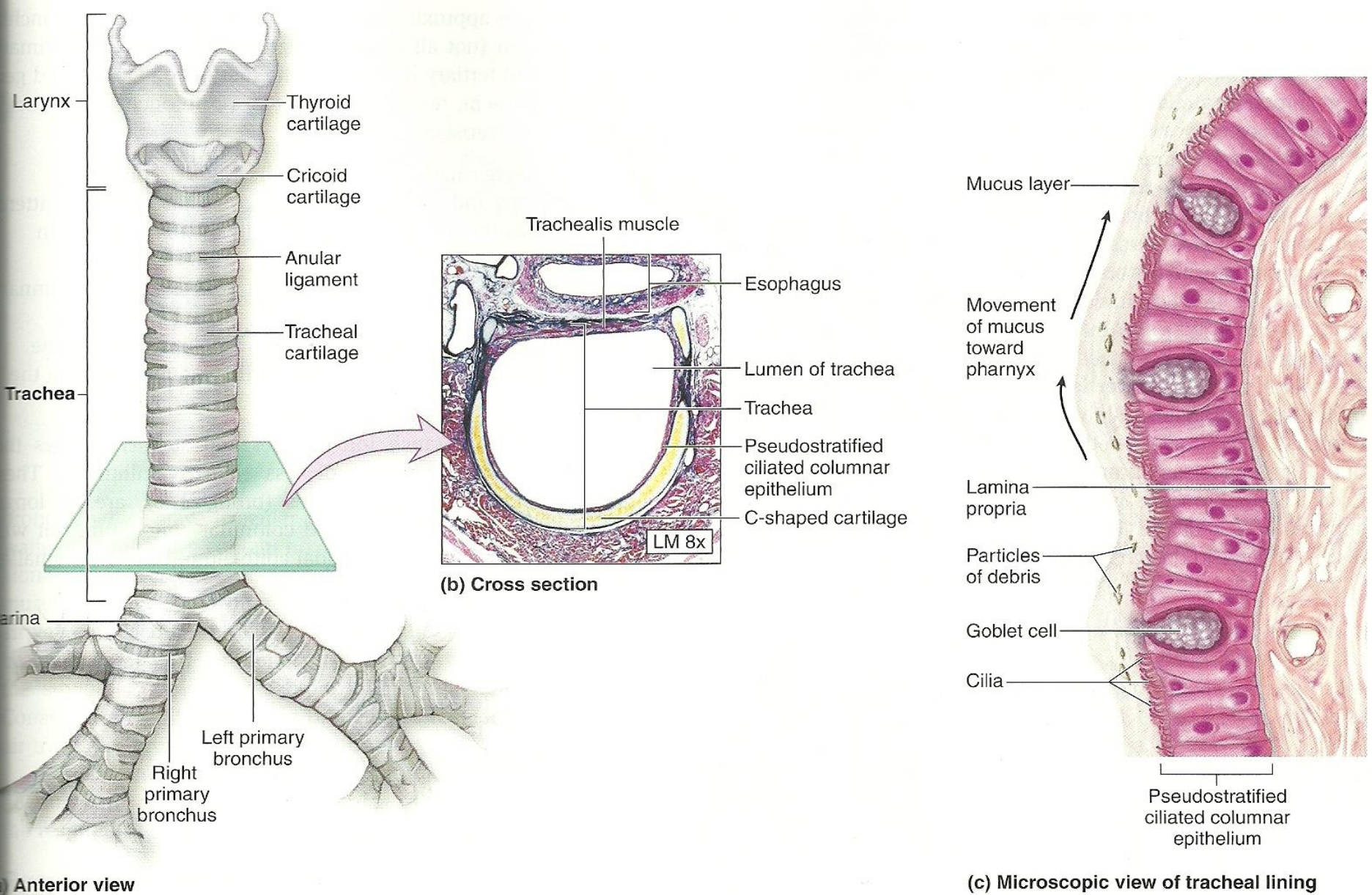
A laryngoscopic view shows the inflamed, reddened vocal folds characteristic of laryngitis.

# TRACHEA, BRONCHIAL TREE AND ALVEOLI

## I. Structures of the Wall of Trachea

1. Mucosa.
2. Submucosa and glands.
3. Muscularis mucosa.
4. Tracheal cartilage.
5. Anular ligaments.

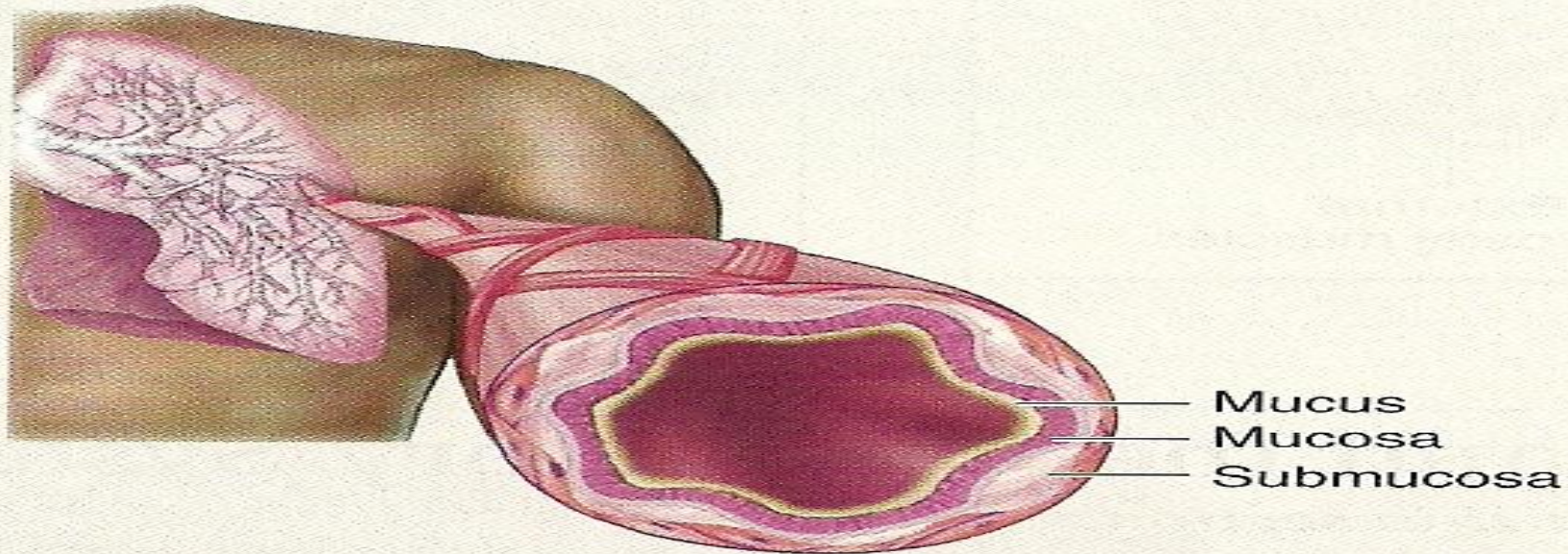




**Figure 25.7**

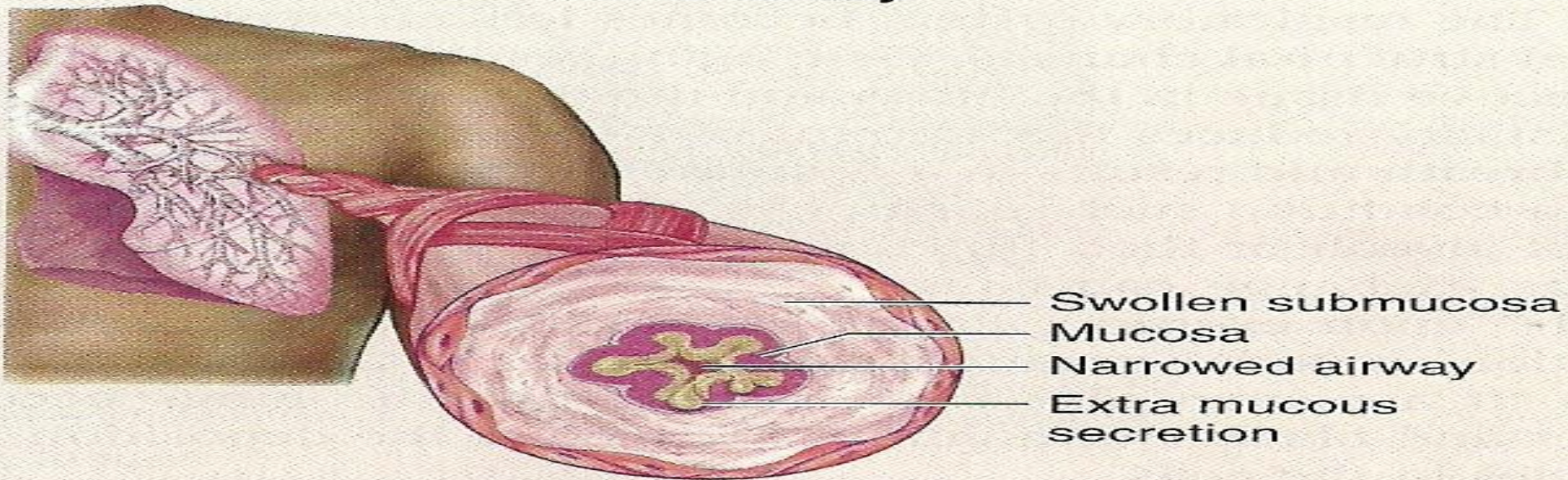
**Trachea.** (a) The trachea connects the larynx superiorly and the primary bronchi inferiorly. (b) A cross-sectional photomicrograph shows the relationship of the trachea (anteriorly) and the esophagus (posteriorly). The wall of the trachea is supported by C-shaped rings of cartilage. (c) The trachea is lined with a pseudostratified ciliated columnar epithelium that propels mucus and debris away from the lungs and toward the pharynx.





Mucus  
Mucosa  
Submucosa

**Normal airway**



Swollen submucosa  
Mucosa  
Narrowed airway  
Extra mucous secretion

**Airway during an asthma attack**

Airway involvement in asthma.

## Structures of Bronchial Tree

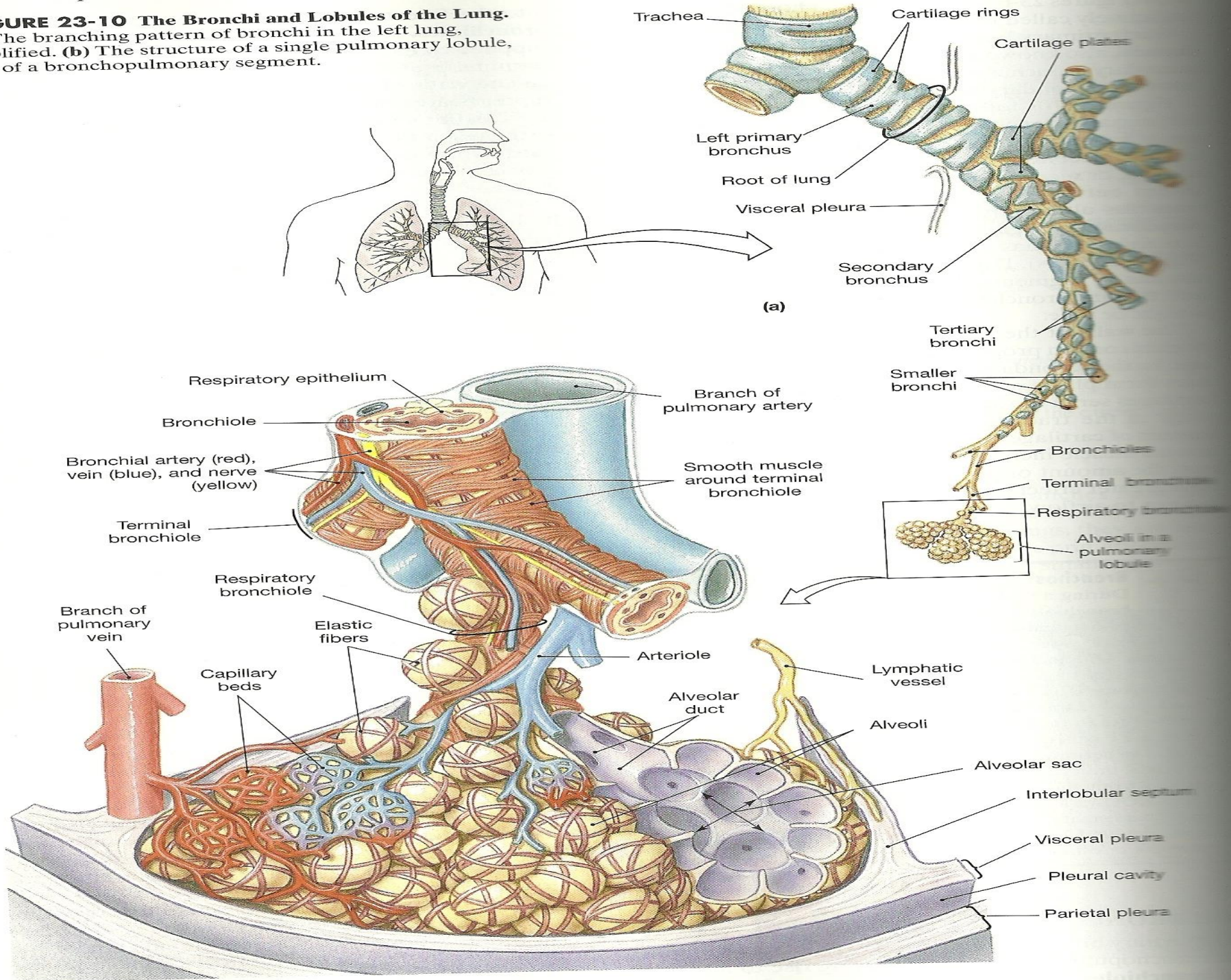
1. Primary bronchus.
2. Secondary bronchus.
3. Tertiary bronchus.
4. Small bronchus.
5. Bronchiole.
6. Terminal bronchiole.
7. Respiratory bronchiole.
8. Alveolar duct.
9. Alveolar.



# Structures of the Wall of Bronchiole

1. Mucosa.
2. Submucosa and glands.
3. Muscularis.

• **FIGURE 23-10 The Bronchi and Lobules of the Lung.**  
**(a)** The branching pattern of bronchi in the left lung, simplified. **(b)** The structure of a single pulmonary lobule, part of a bronchopulmonary segment.



# Bronchi and Lobules of the Lung

|                  | Name of branches        | Number of tubes in branch |
|------------------|-------------------------|---------------------------|
| Conducting zone  | Trachea                 | 1                         |
|                  | Bronchi                 | 2                         |
|                  |                         | 4                         |
|                  | Bronchioles             | 8                         |
|                  |                         | 16                        |
|                  | Terminal bronchioles    | 32                        |
| Respiratory zone | Respiratory bronchioles | $6 \times 10^4$           |
|                  |                         | $5 \times 10^5$           |
|                  | Alveolar ducts          |                           |
|                  | Alveolar sacs           | $8 \times 10^6$           |

The diagram illustrates the branching pattern of the airway. It starts with a single trachea at the top, which branches into two bronchi. These bronchi further branch into four bronchioles, which then branch into eight more bronchioles. The next level is terminal bronchioles, with 32 shown. From the terminal bronchioles, the airway enters the respiratory zone, starting with respiratory bronchioles (6 x 10^4), which branch into alveolar ducts (5 x 10^5), and finally into alveolar sacs (8 x 10^6). The diagram uses a color gradient from pink to purple to represent the different levels of branching.

C

**FIGURE 35-1** (Continued) **C** The branching patterns of the airway during the transition from conducting to respiratory airway are drawn (not all divisions are drawn, and drawings are not to scale).



## **Functions of Bronchioles**

1. Conduct air.
2. Smooth muscle in the walls allows for bronchoconstriction and bronchodilation.



## Structures of Alveolar Duct and Alveoli

1. Type I Alveolar cell called Squamous alveolar cell.
2. Type II alveolar cell.
3. Alveolar macrophage called dust cell.
4. Elastic fibers.
5. Smooth muscle.
6. Capillaries.

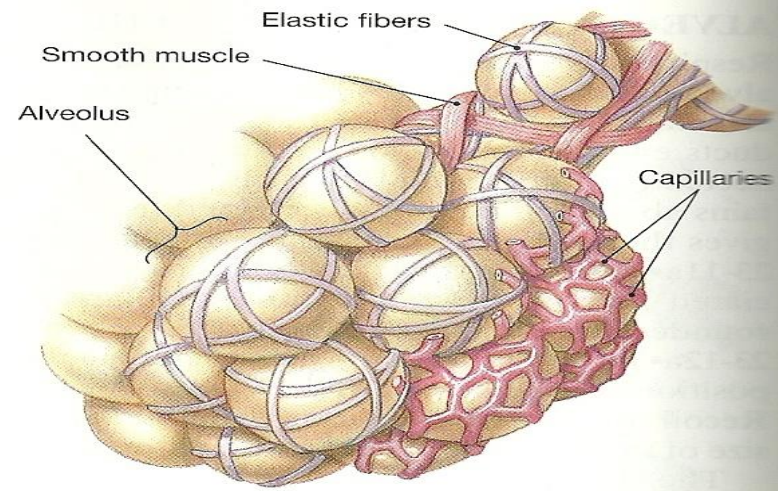
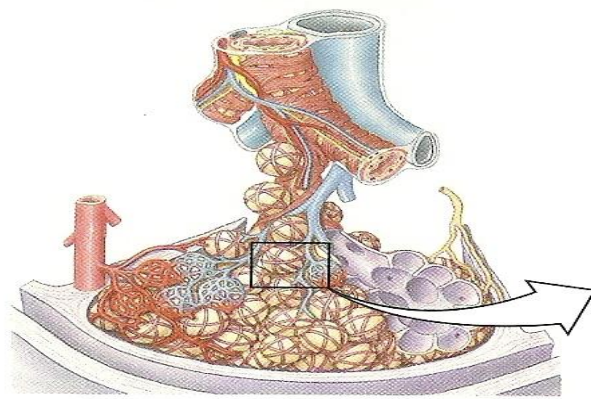
**Each lung contains about 150 million alveoli.**

**Function:** the alveolus is the site of gas exchange "the functional unit of respiration"

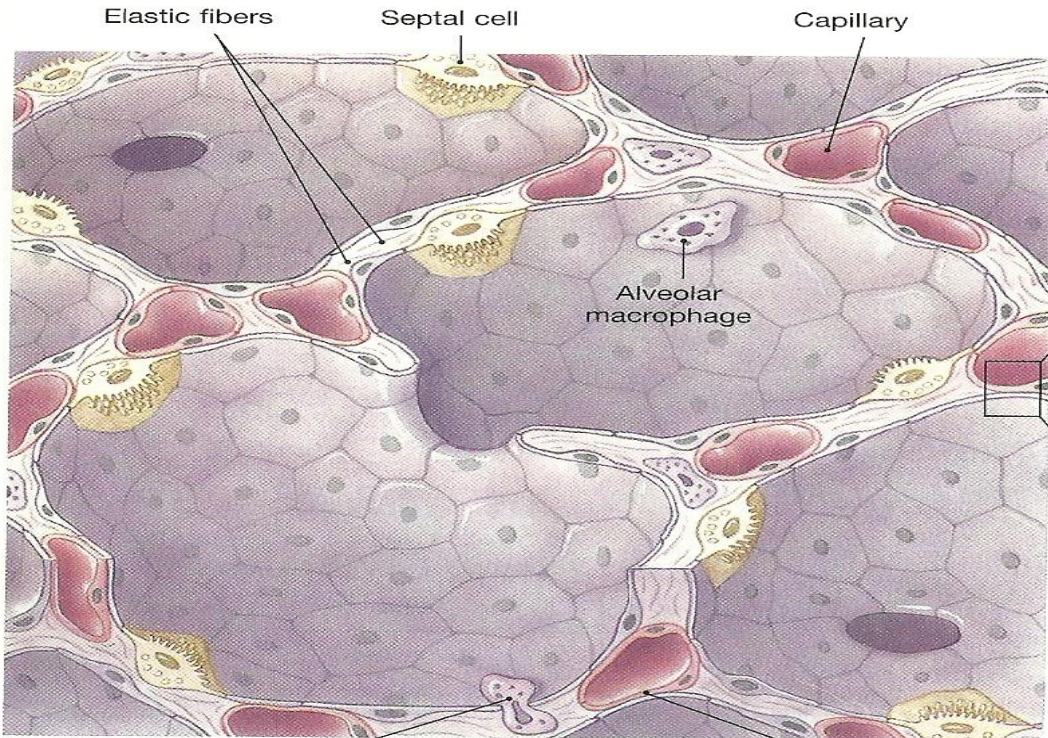
# Respiratory Membrane

Thin wall between the inhaled gases within the alveolar lumen and blood capillaries, consist from:

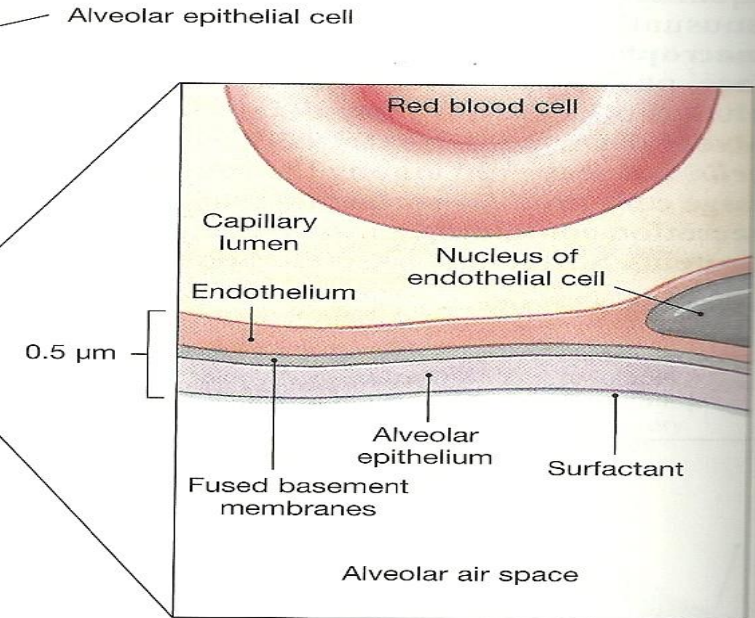
- 1. Alveolar epithelium or cell membrane of type I alveolar cell.**
- 2. Endothelial cell of capillaries.**
- 3. Fused basement membrane.**



(a)



(b)



(c)

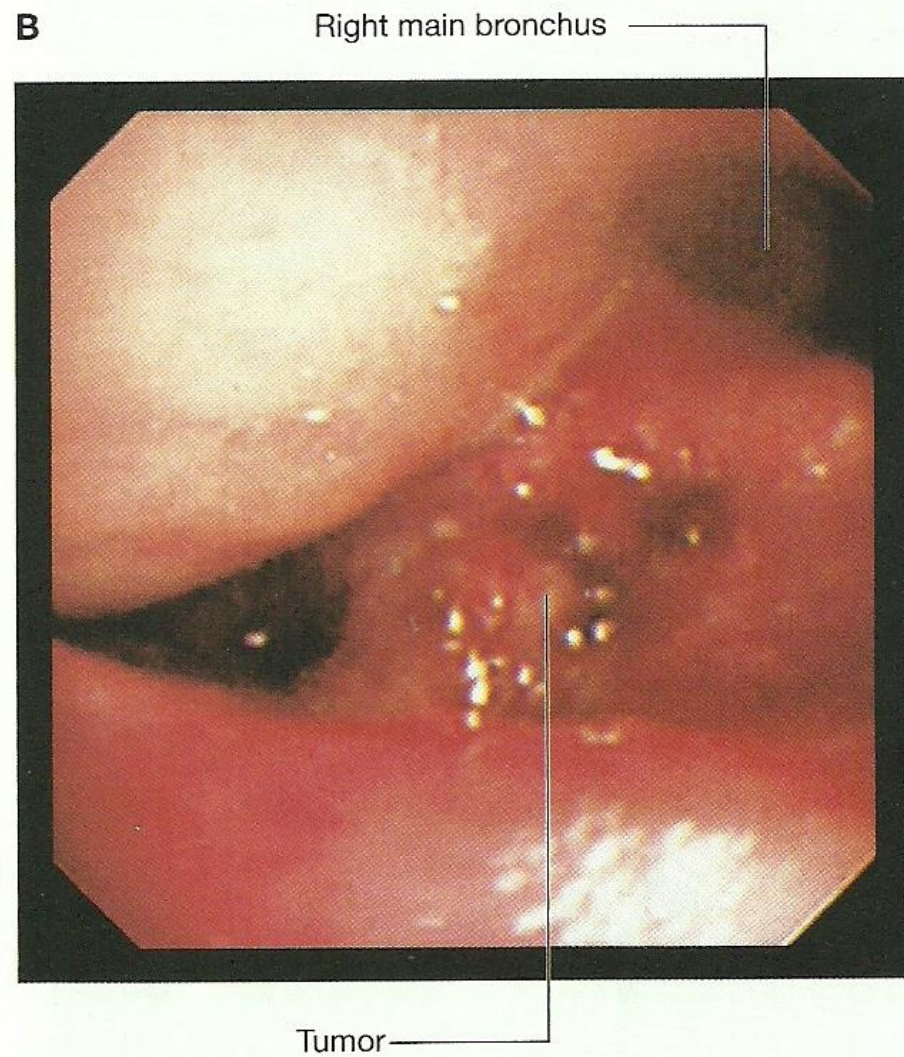
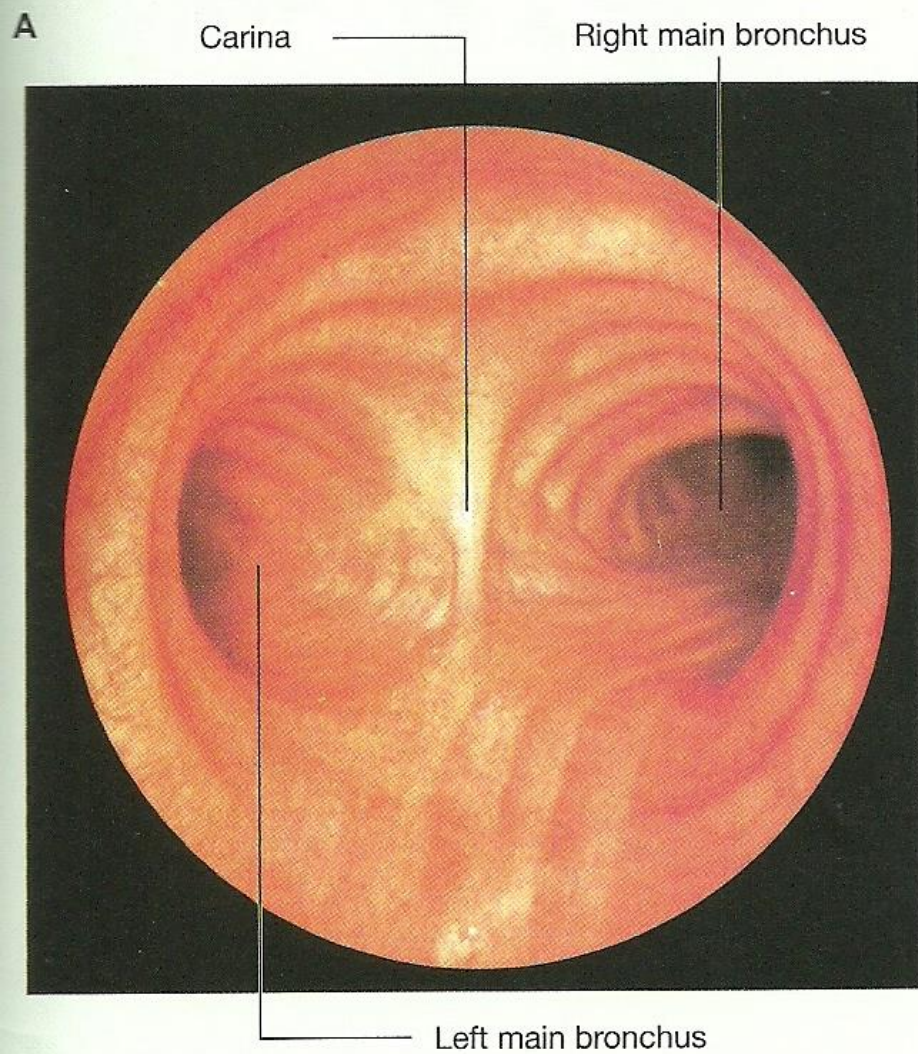
Alveolar macrophage (b) Endothelial cell of capillary

**FIGURE 23-12 Alveolar Organization.** (a) The basic structure of a portion of a single lobule. A network of capillaries, supported by elastic fibers, surrounds each alveolus. Respiratory bronchioles also contain wrappings of smooth muscle that can change the diameter of these airways. (b) A diagrammatic view of alveolar structure. A single capillary may be involved with gas exchange across several alveoli simultaneously. (c) The respiratory membrane, which consists of an alveolar epithelial cell, a capillary endothelial cell, and their fused basement membranes.



# Clinical Disorders of Trachea and Alveoli

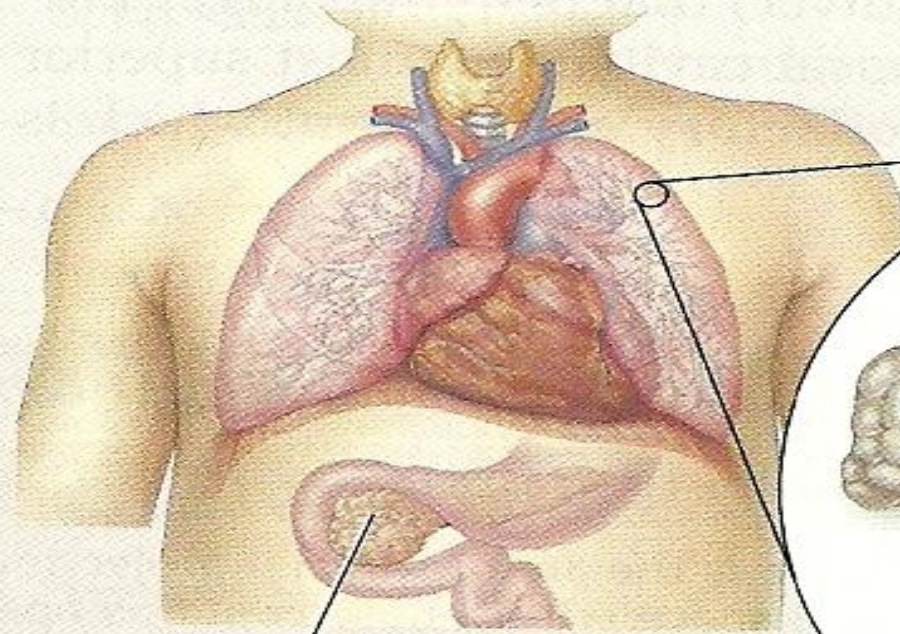
## tumor at the carina



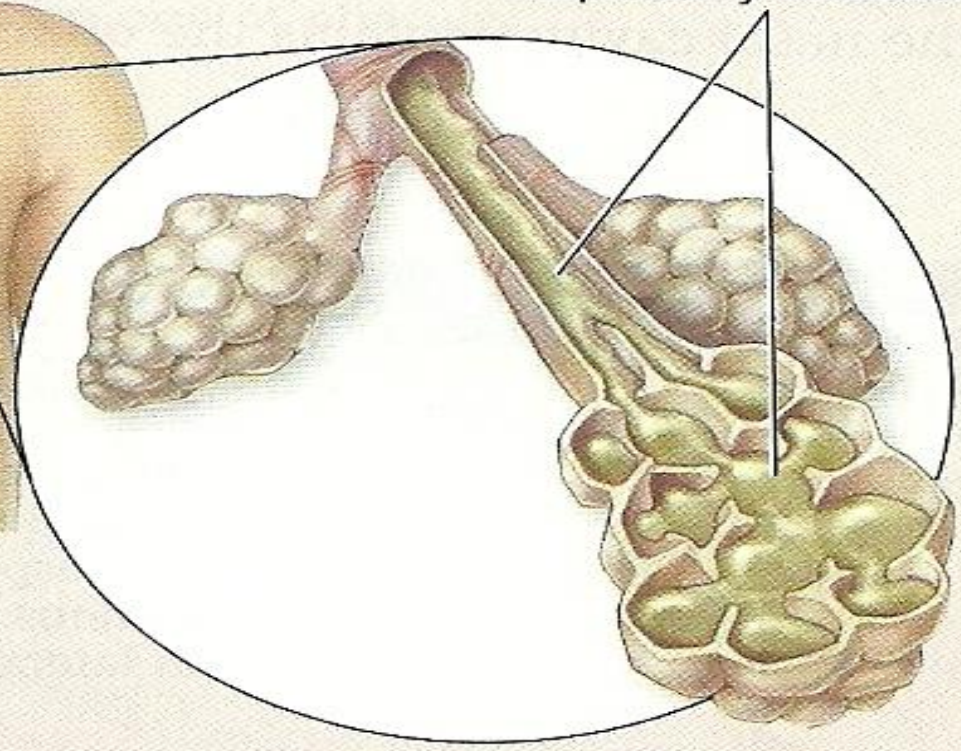
**Fig. 3.48** Bronchoscopic evaluation. **A.** Of the lower end of the trachea and its main branches. **B.** Of tracheal bifurcation showing a tumor at the carina.



# Cystic Fibrosis



Mucus builds up and blocks the bronchial tree, leading to chronic respiratory infections.



Mucus buildup blocks the pancreatic ducts and prevents digestive enzymes from entering the small intestine.

Cystic fibrosis results in thickened mucus that obstructs both the respiratory passageways and the pancreatic ducts.

# LUNGS AND PLEURAL MEMBRANES

## I. Lungs:

**1. Right lung** composed from three lobes

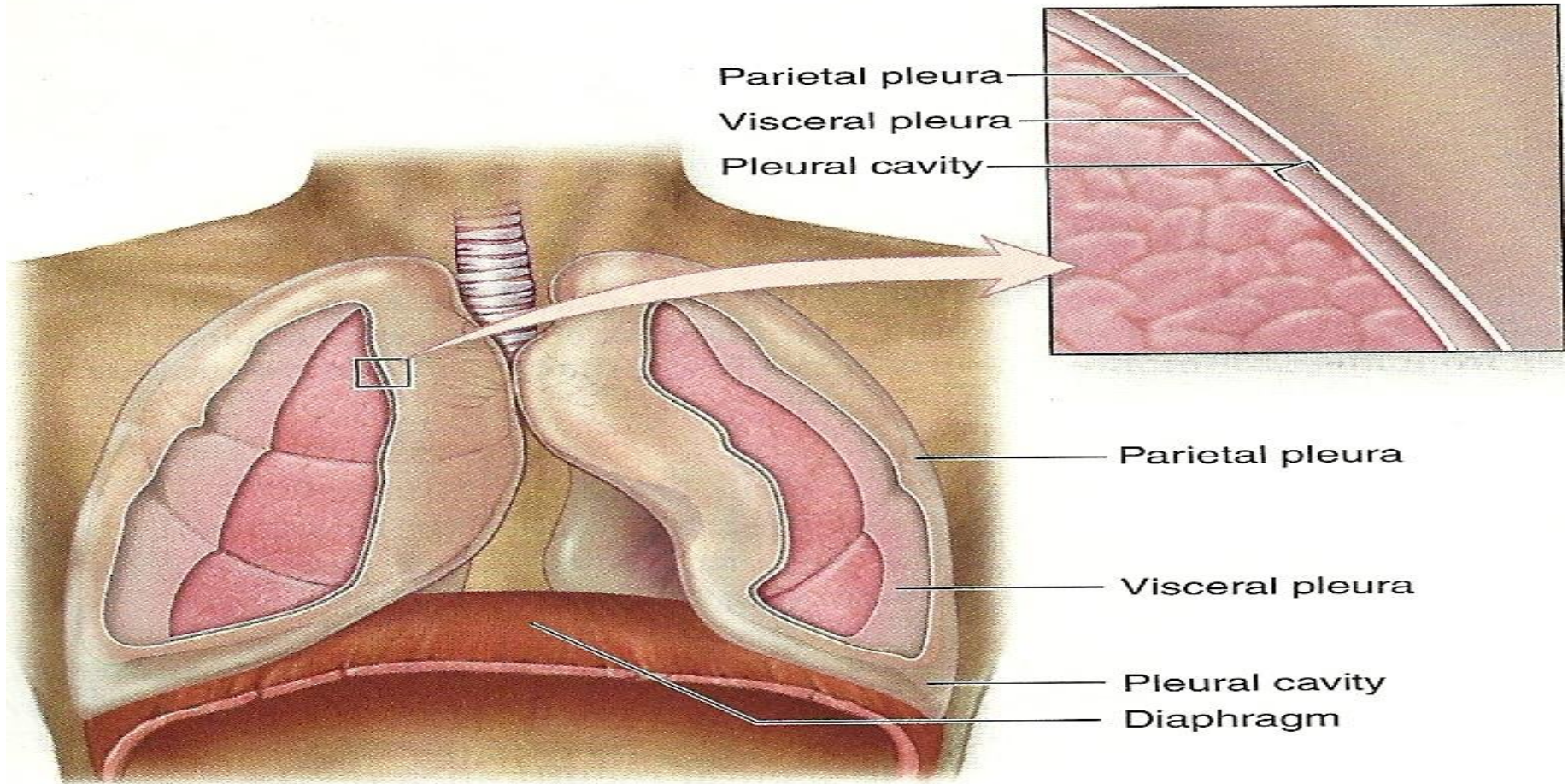
- a. Super lobe.
- b. Middle lobe.
- c. Inferior lobe.

**2. Left lung** is smaller than the righten  
and composed from two lobes.

- a. Superior lobe.
- b. Inferior lobe.



# pleural membranes

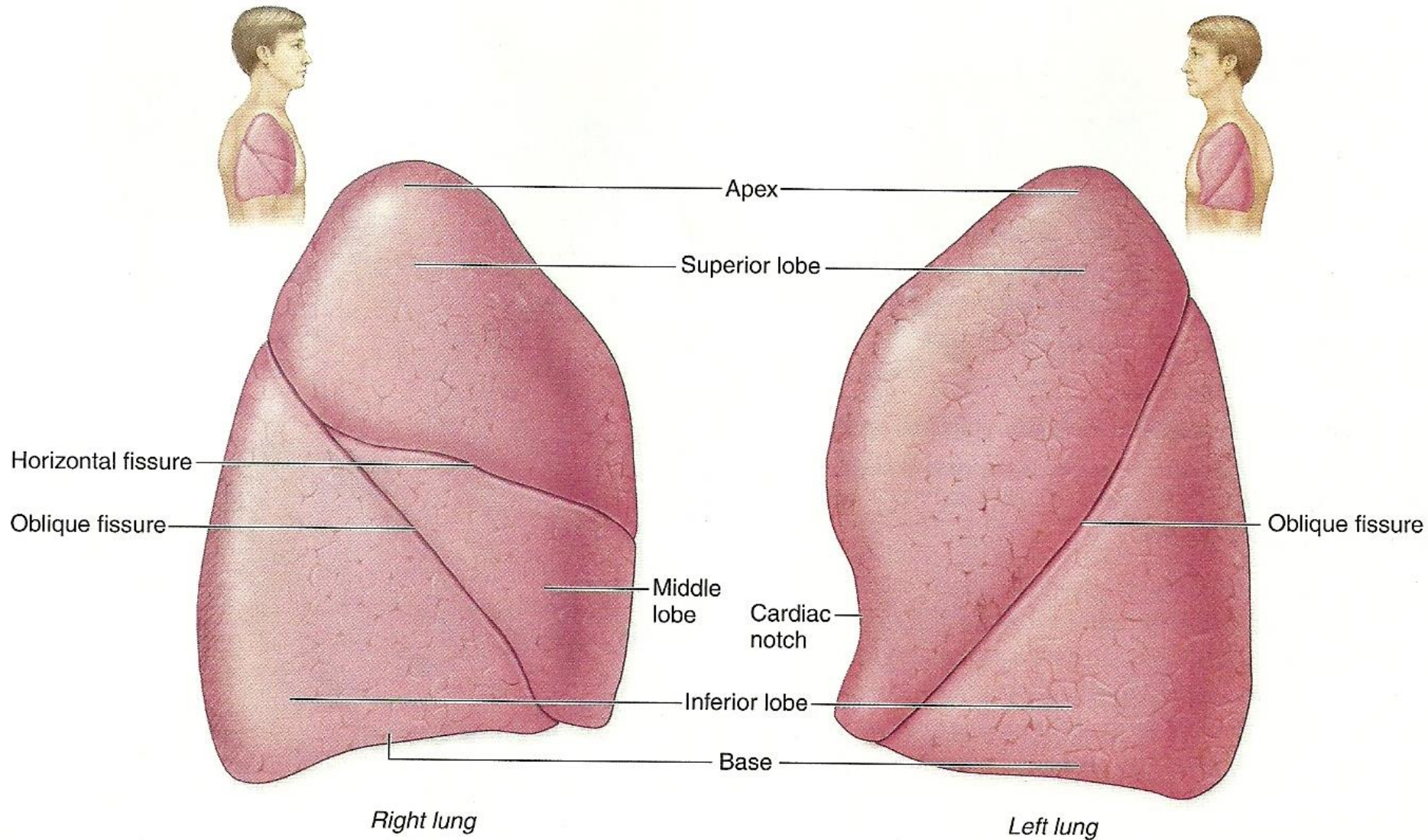


**Figure 25.11**

**Pleural Membranes.** The serous membranes associated with the lungs are called the pleural membranes. The parietal pleura lines the inner surface of the thoracic cavity, and the visceral pleura covers the outer surface of the lungs. The thin space between these layers is called the pleural cavity.



# Gross anatomy of the lungs



(a) Lateral views

# Pleural Membrane

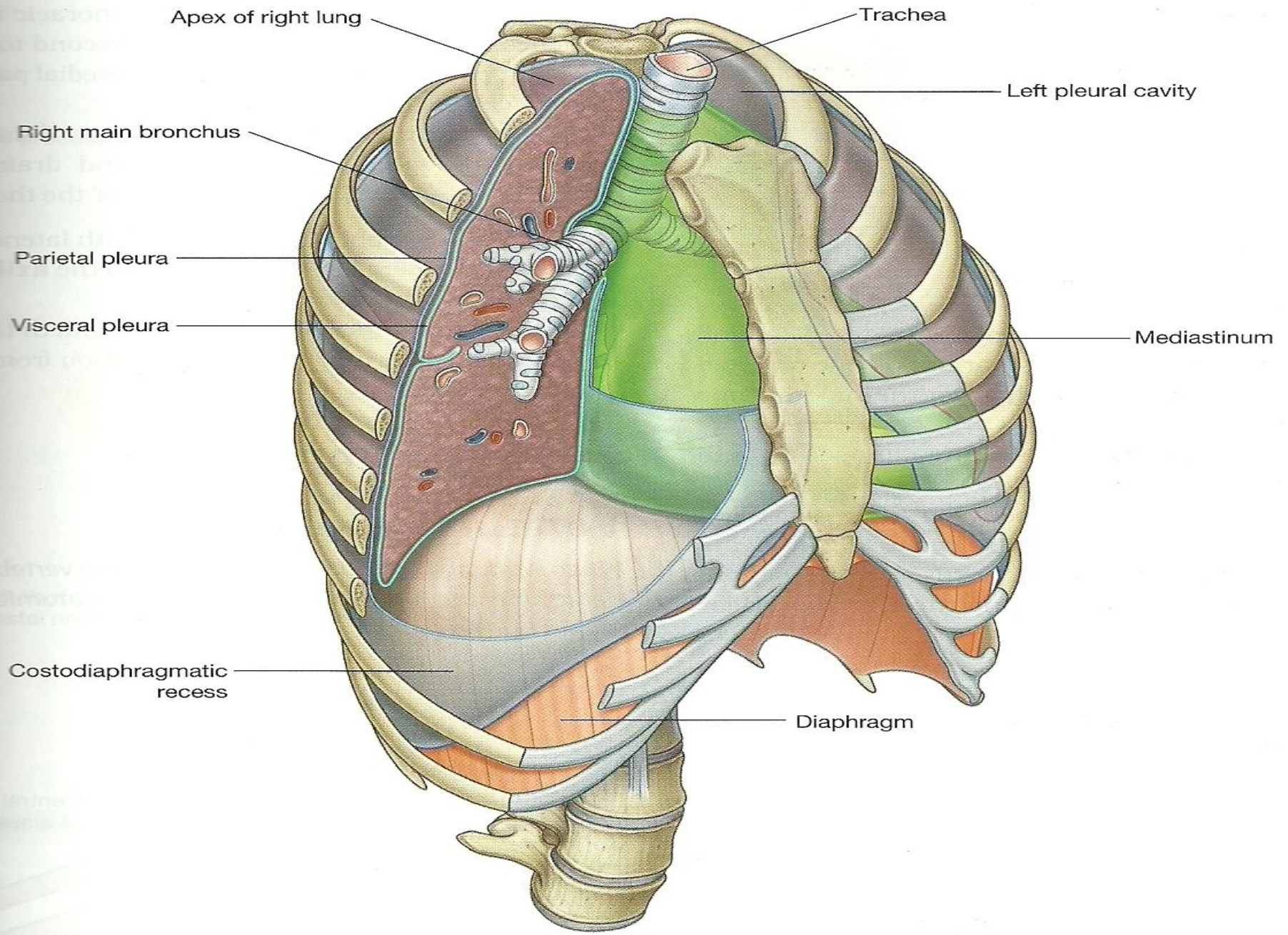
Serous membrane associated with the lung consists from:

- 1. Parietal pleura** lines the inner surface of the thoracic cavity.
- 2. Visceral pleura** cover the outer surface of the lungs.

# Pleural Cavity

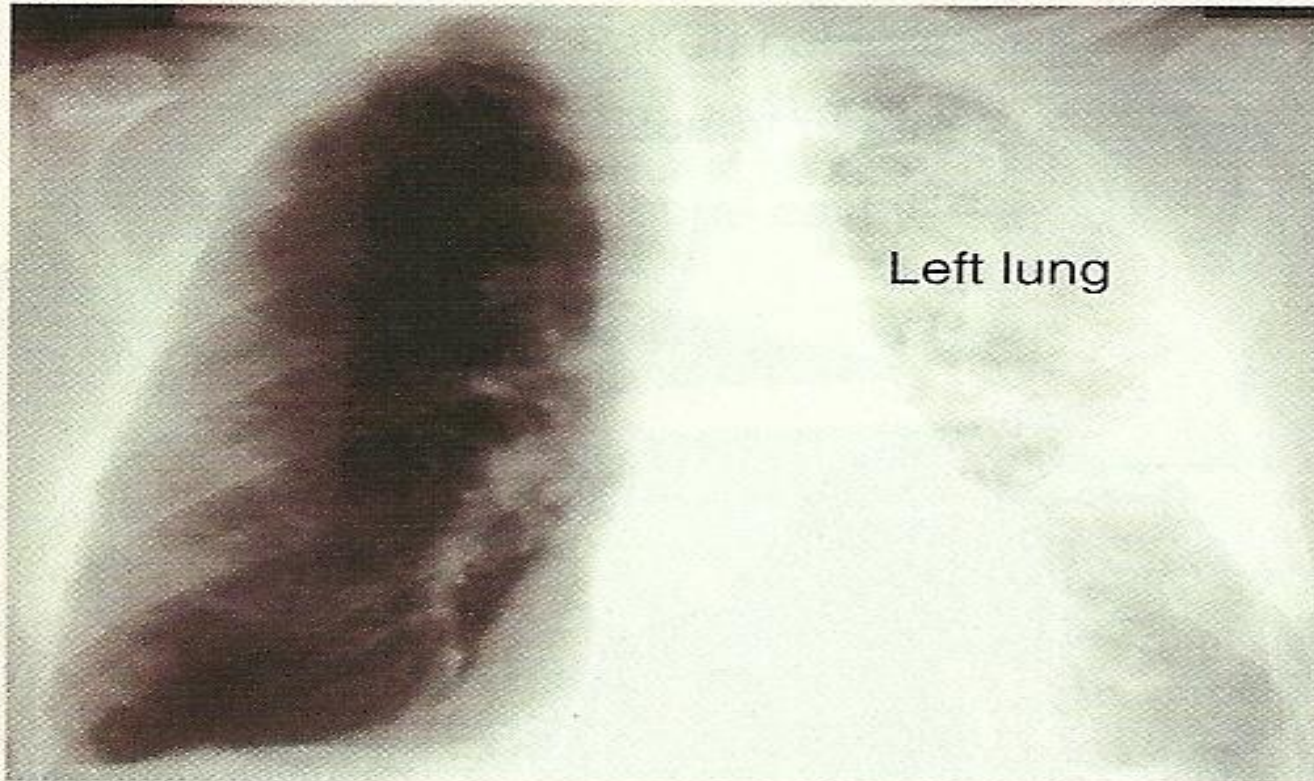
The thin space between parietal pleura and visceral pleura called pleural cavity. Both pleura secrete a small amount of pleural fluid .Pleural fluid gives a moist, slippery coating that provides lubrication, thereby reducing friction between the parietal and visceral surfaces as you breathe.





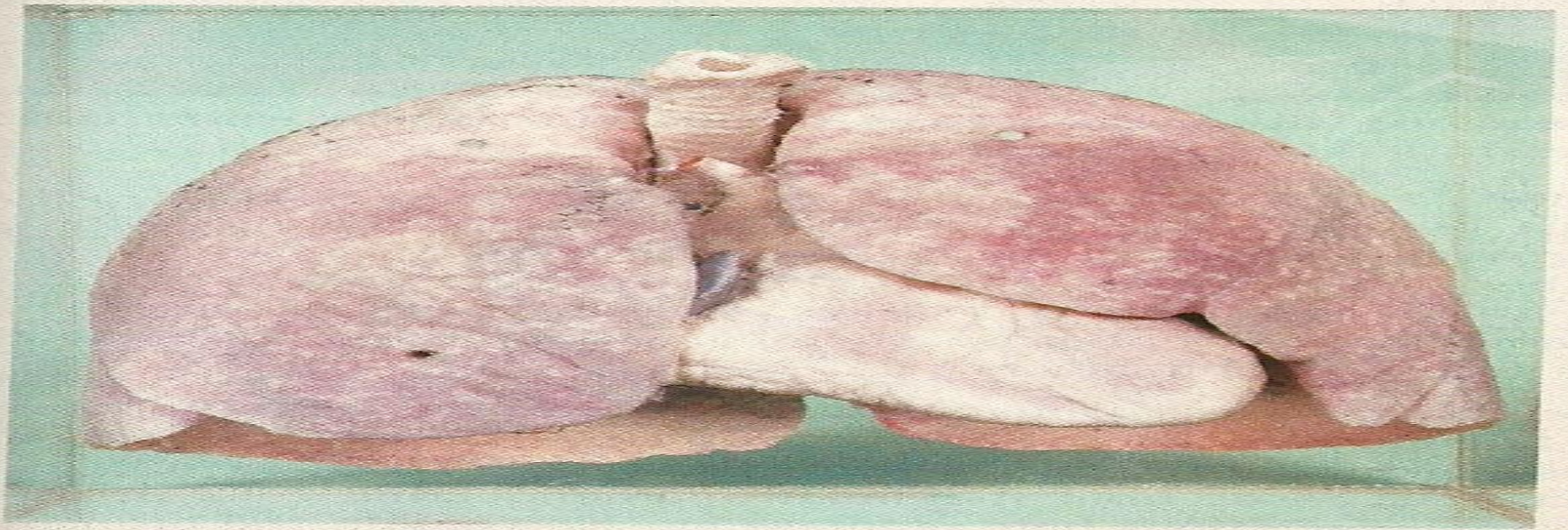


# Clinical Disorders of Lungs

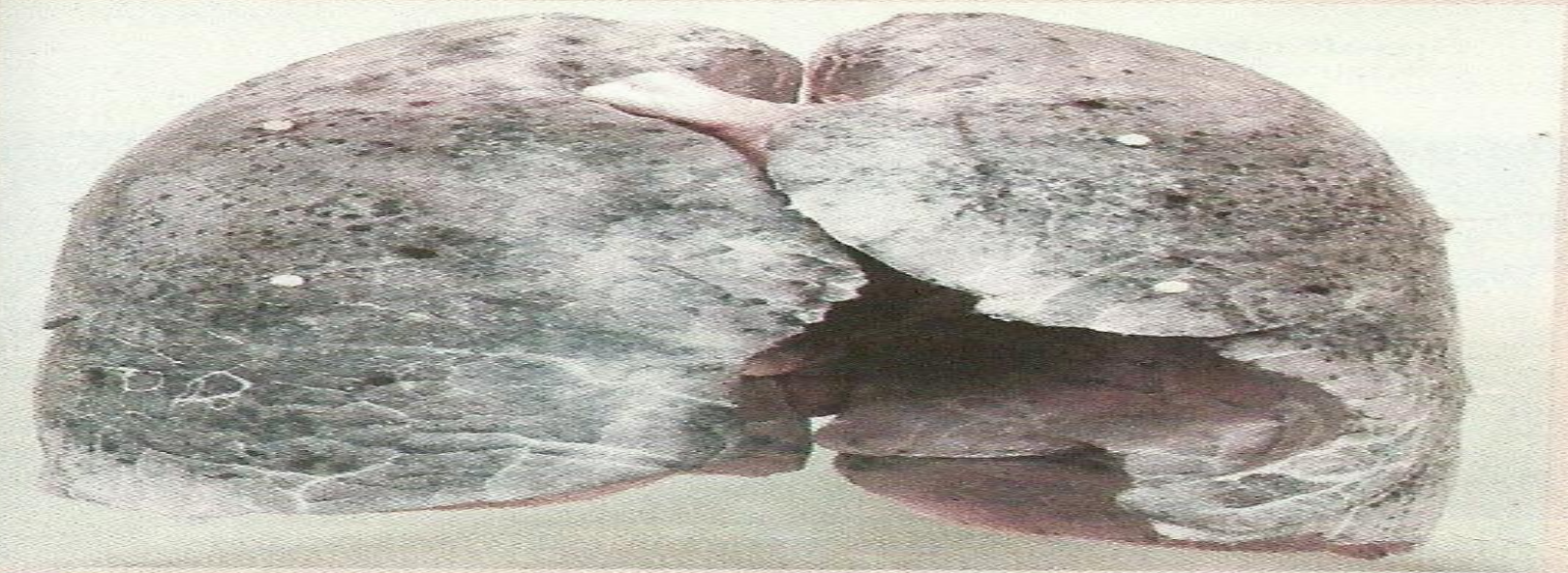


Chest x-ray of a patient with pneumonia in the left lung. A normal lung appears as a black space on an x-ray because its spongy structure is not dense. In contrast, a pneumonia lung appears white or opaque on an x-ray due to accumulation of fluid and cells.





**Nonsmoker's lungs.**



**Smoker's lungs.**



Squamous cell carcinoma



Gross section of a lung with squamous cell carcinoma (speckled white and black regions).