



Structure and Function of the Pulmonary System

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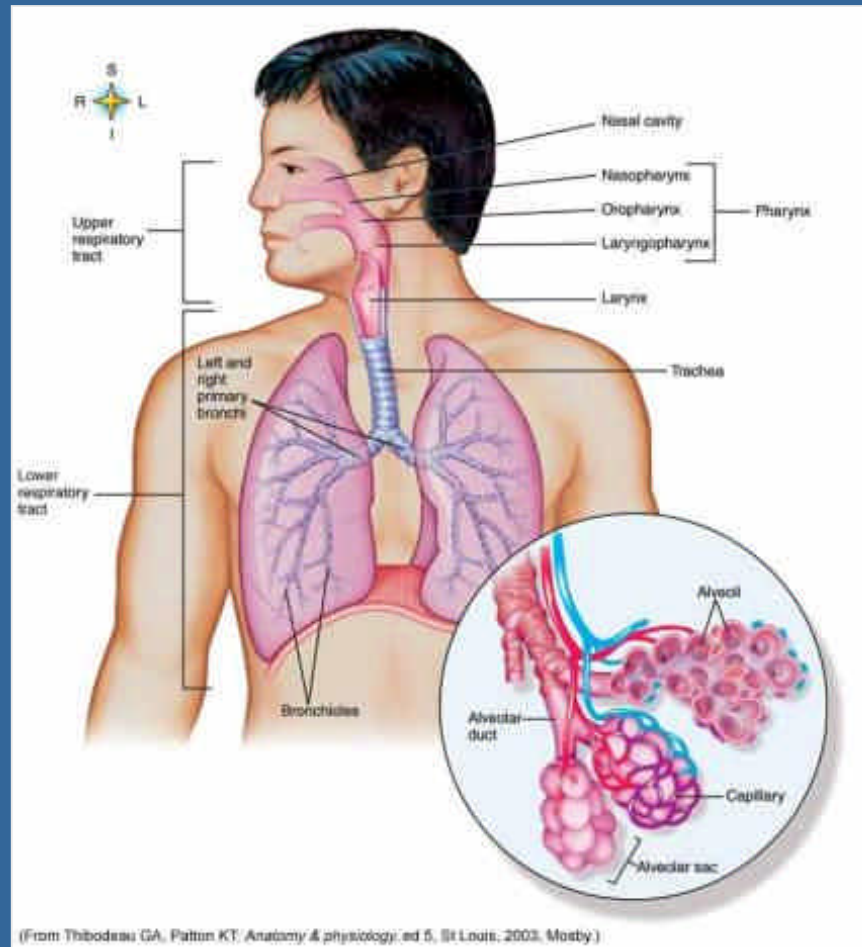


Structures of the Pulmonary System

- Airways
- Blood vessels
- Chest wall
- Lungs
 - Lobes
 - Segments
 - Lobules



Structures of the Pulmonary System

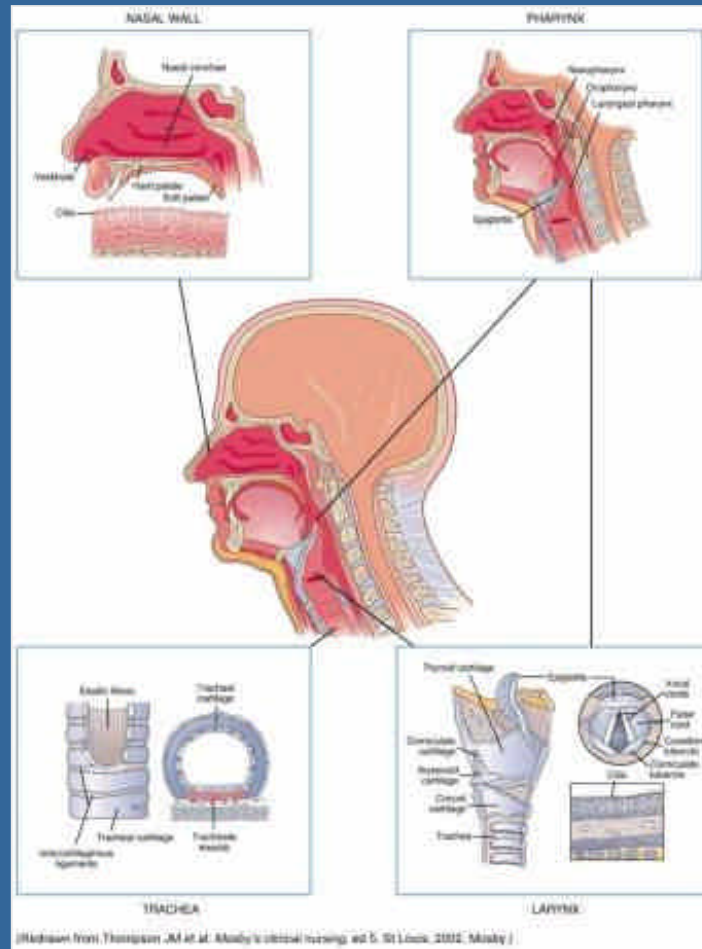




Structures of the Pulmonary System

- Conducting airways
 - Upper airways
 - Nasopharynx
 - Oropharynx
 - Larynx
 - Connects upper and lower airways
 - Lower airways
 - Trachea
 - Bronchi
 - Terminal bronchioles

Structures of the Pulmonary System

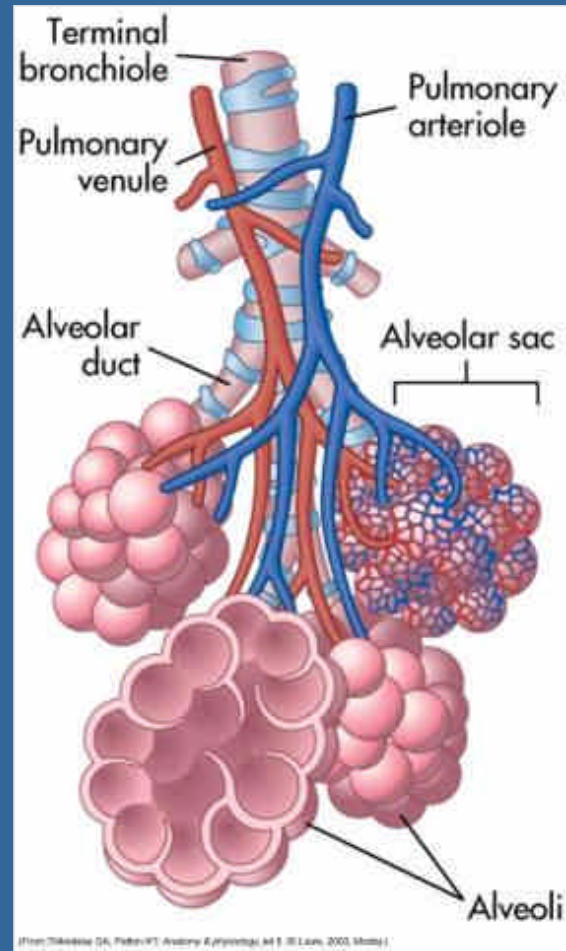


Structures of the Pulmonary System

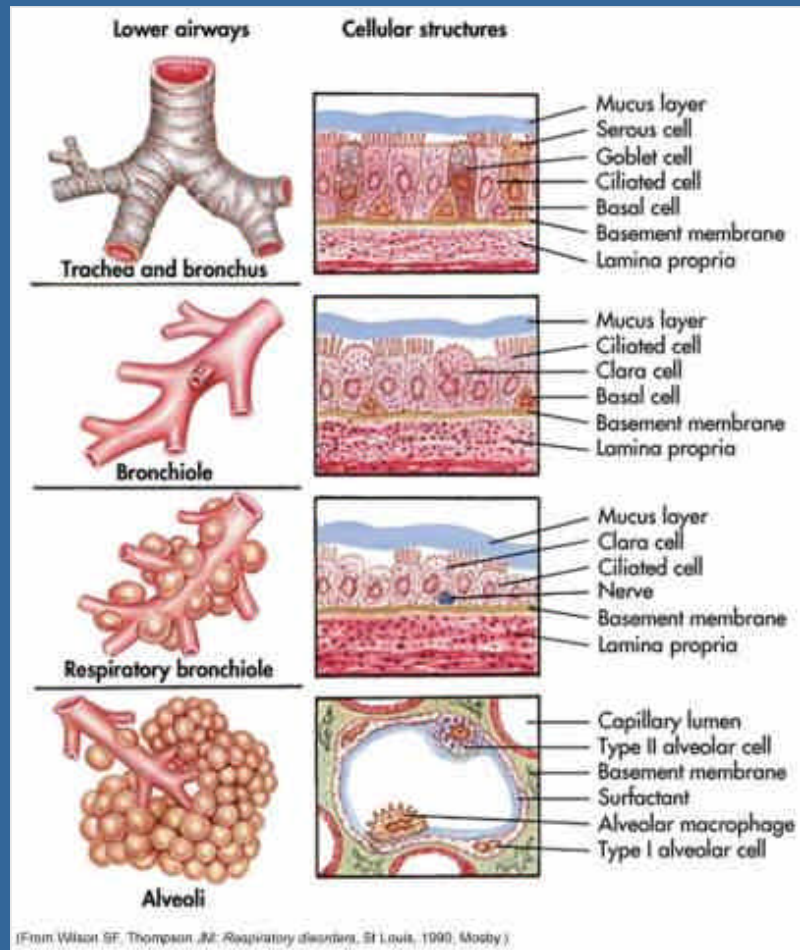
CONDUCTING AIRWAYS		RESPIRATORY UNIT		
TRACHEA	SEGMENTAL BRONCHI	SUBSEGMENTAL BRONCHI (BRONCHIOLES)		ALVEOLAR DUCTS
		Nonrespiratory	Respiratory	
GENERATIONS	8	16	24	26

(Redrawn from Thompson JM et al: *Mosby's clinical nursing*, ed 5, St Louis, 2002, Mosby.)

Structures of the Pulmonary System



Structures of the Pulmonary System

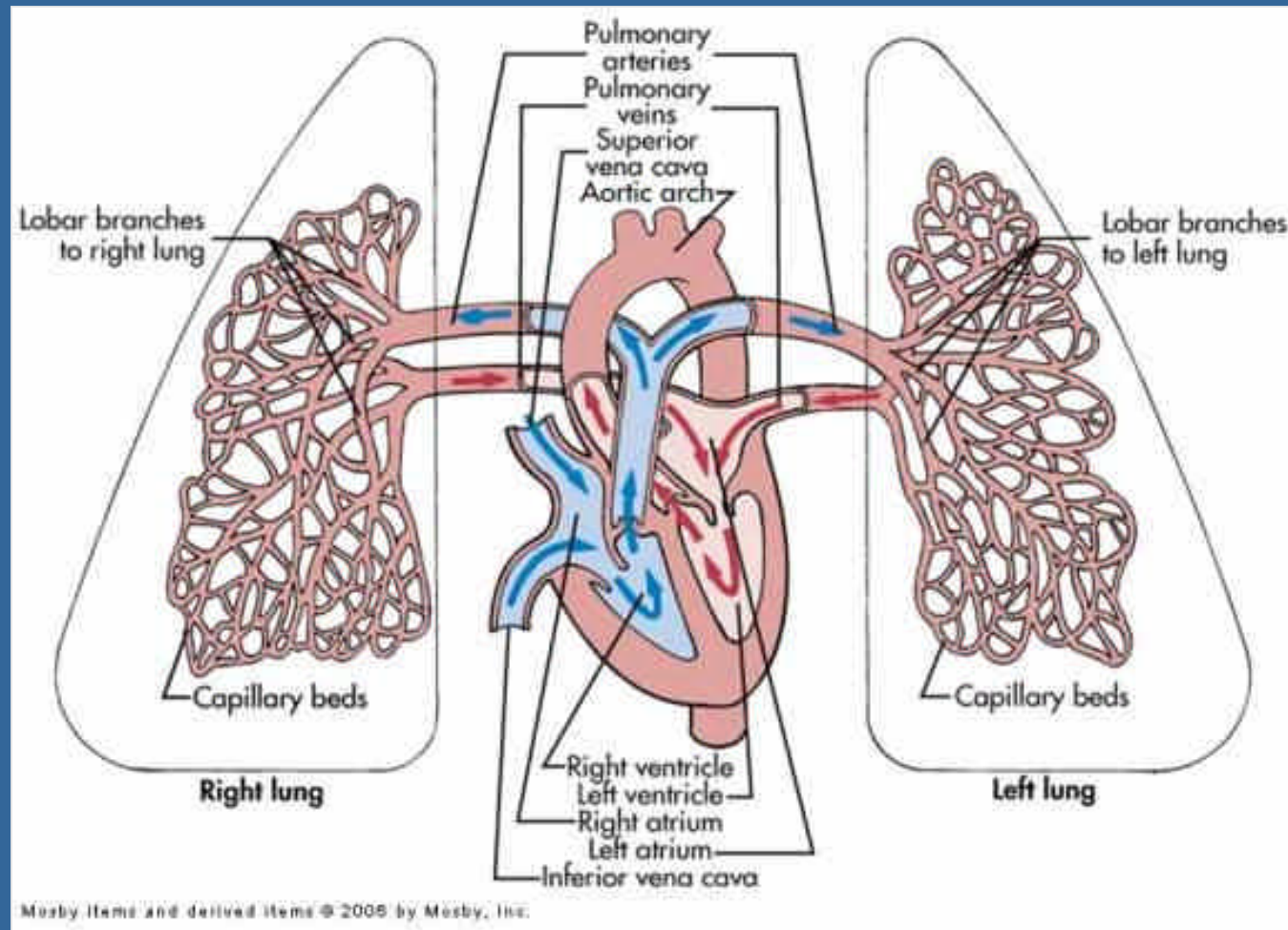




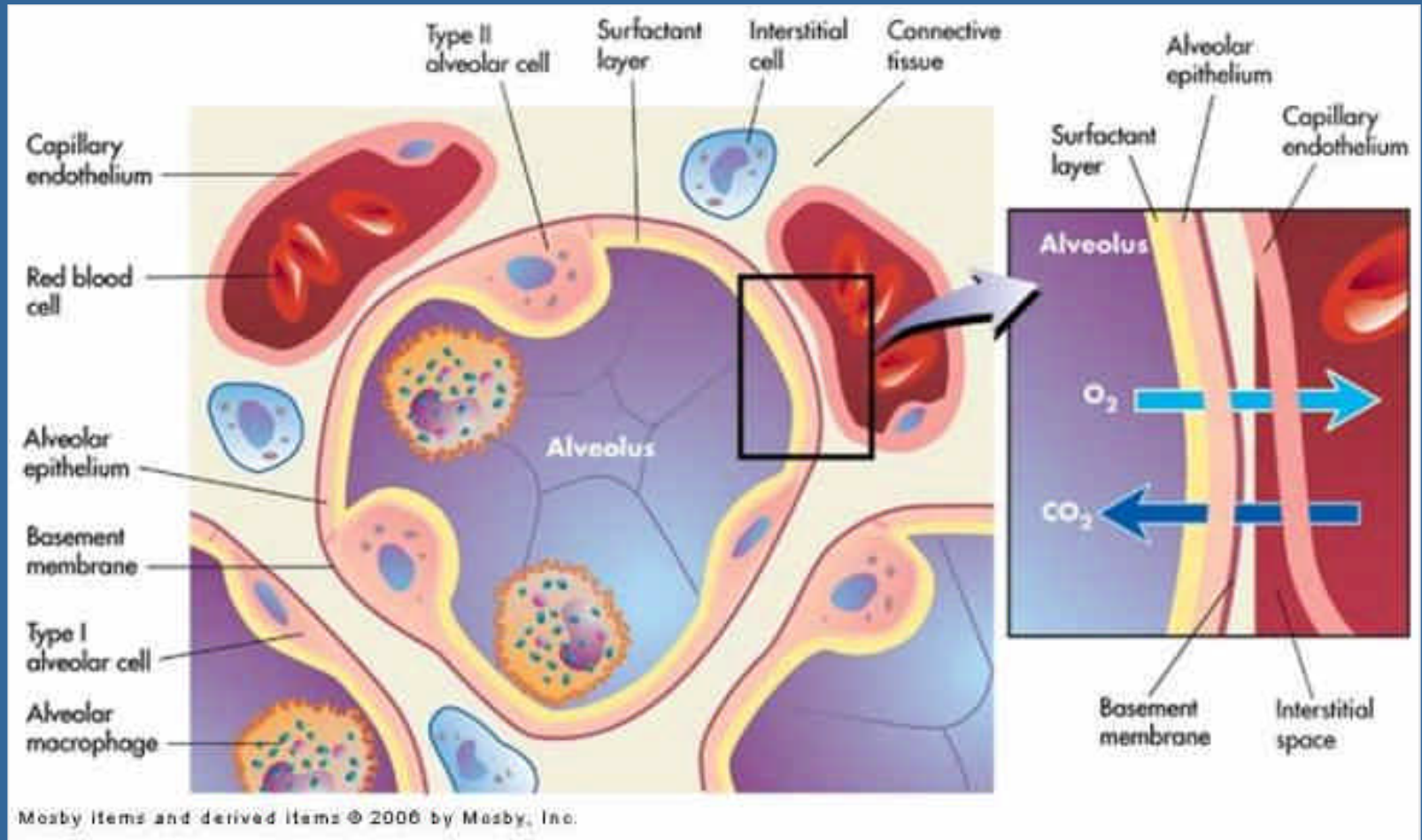
Pulmonary and Bronchial Circulation

- Pulmonary circulation has a lower pressure than the systemic circulation
- One third of pulmonary vessels are filled with blood at any given time
- Pulmonary artery divides and enters the lung at the hilus
- Each bronchus and bronchiole has an accompanying artery or arteriole

Pulmonary and Bronchial Circulation



Pulmonary and Bronchial Circulation



An anatomical illustration on the left side of the slide, showing a cross-section of the chest wall and pleura. It depicts the skin, ribs, intercostal muscles, the thoracic cavity, and the pleural space with its fluid. The illustration uses various colors like blue, green, yellow, and brown to differentiate the different layers and structures.

Chest Wall and Pleura

- Chest wall
 - Skin, ribs, and intercostal muscles
 - Thoracic cavity
- Pleura
 - Serous membrane
 - Parietal and visceral layers
 - Pleural space (cavity)
 - Pleural fluid



Function of the Pulmonary System

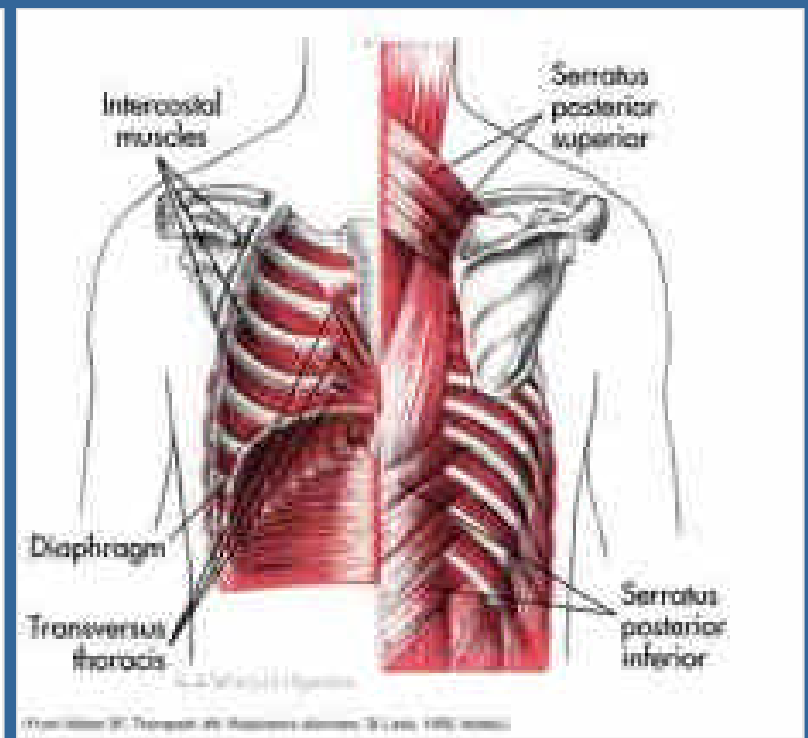
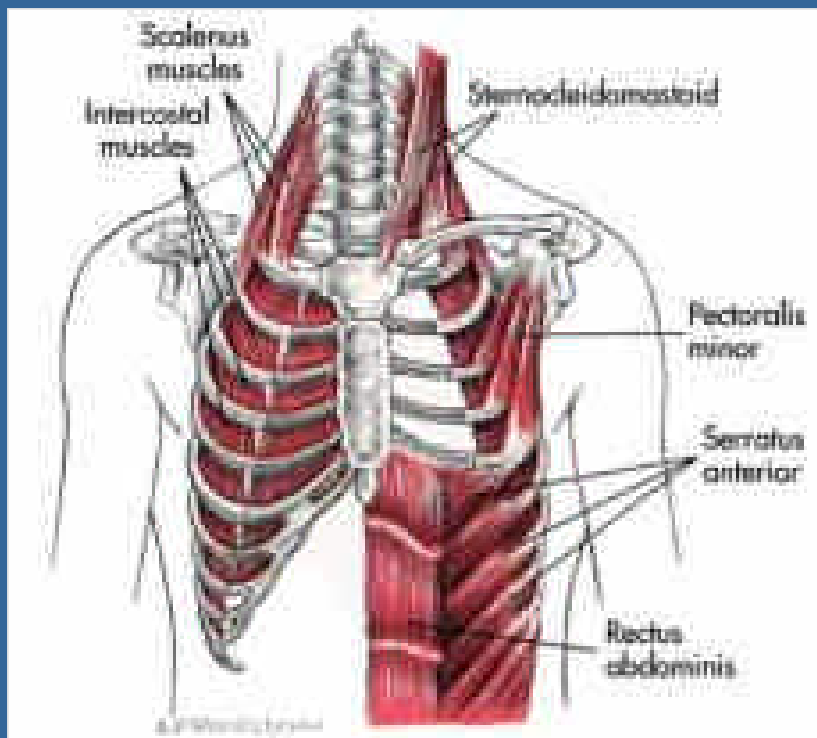
- Ventilation
 - Mechanical movement of gas or air into and out of the lungs
 - Minute volume
 - Ventilatory rate multiplied by the volume of air per breath
 - Alveolar ventilation



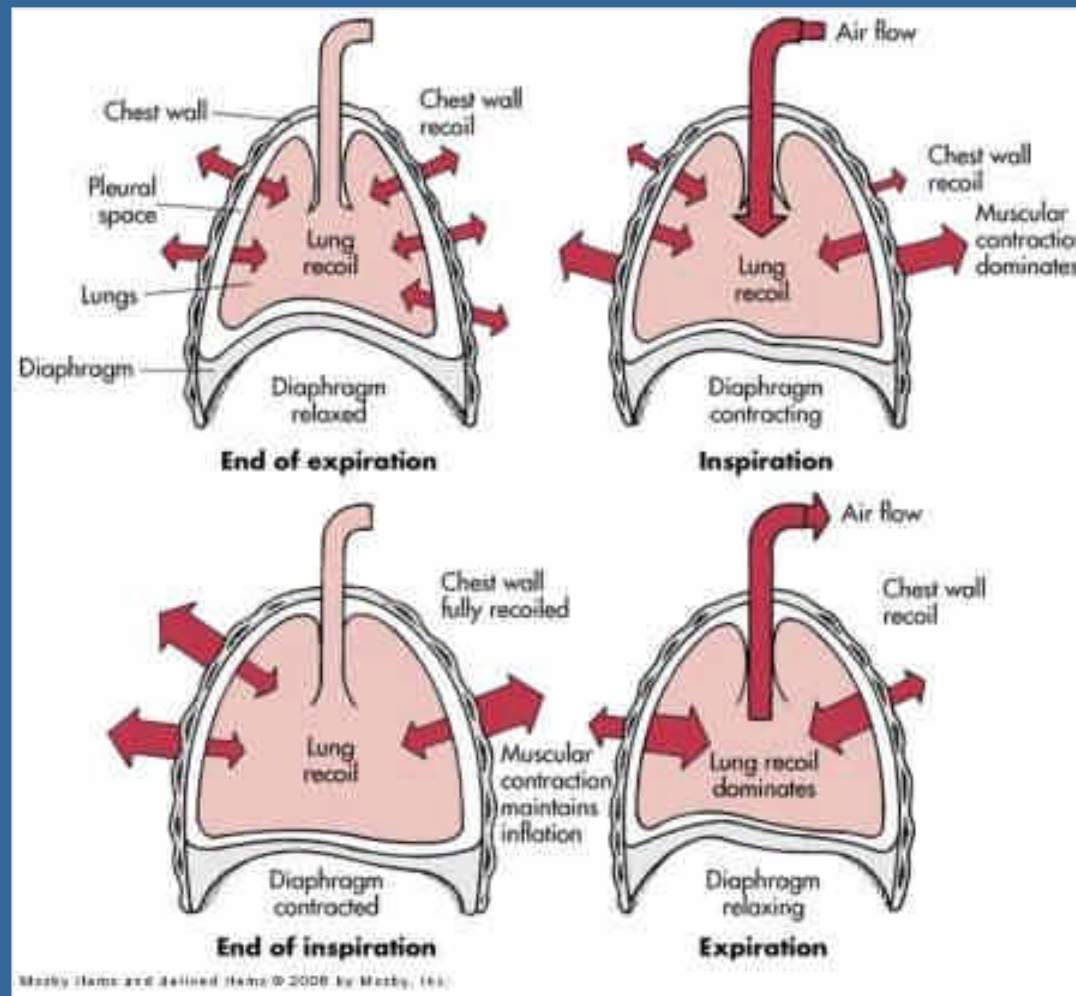
Mechanics of Breathing

- Major and accessory muscles
 - Major muscles of inspiration
 - Diaphragm
 - External intercostals
 - Accessory muscles of inspiration
 - Sternocleidomastoid and scalene muscles
 - Accessory muscles of expiration
 - Abdominal and internal intercostal muscles

Muscles of Ventilation



Mechanics of Breathing





Gas Transport

- Four steps
 - Ventilation of the lungs
 - Diffusion of oxygen from the alveoli into the capillary blood
 - Perfusion of systemic capillaries with oxygenated blood
 - Diffusion of oxygen from systemic capillaries into the cells
- Diffusion of CO₂ occurs in reverse order



Tests of Pulmonary Function

- Spirometry
- Diffusion capacity
- Residual volume
- Functional reserve capacity (FRC)
- Total lung capacity
- Arterial blood gas analysis
- Chest radiographs

An abstract painting of a human face, rendered in a style reminiscent of Vincent van Gogh's 'Self-Portrait with Bandaged Ear'. The face is composed of various textured, geometric shapes in shades of blue, green, yellow, and brown. The eyes are closed, and the overall composition is highly stylized and expressive.

Signs and Symptoms of Pulmonary Disease

- Dyspnea
 - Subjective sensation of uncomfortable breathing
 - Orthopnea
 - Dyspnea when a person is lying down
 - Paroxysmal nocturnal dyspnea
- Abnormal breathing patterns
 - Kussmaul respirations (hyperpnea)
 - Cheyne-Stokes respirations



Signs and Symptoms of Pulmonary Disease

- Hypoventilation
- Hyperventilation
- Cough
 - Acute cough
 - Chronic cough
- Hemoptysis



Signs and Symptoms of Pulmonary Disease

- Cyanosis
- Pain
- Clubbing
- Abnormal sputum

An abstract painting of a human face, rendered in a style reminiscent of Vincent van Gogh's 'Owl' or similar expressionist works. The face is composed of various textured, geometric shapes in shades of blue, green, yellow, and brown. The eyes are particularly prominent, with one appearing as a dark, curved shape and the other as a lighter, more defined area. The overall composition is dynamic and expressive.

Conditions Caused by Pulmonary Disease or Injury

- Hypercapnia
- Hypoxemia
 - Hypoxemia versus hypoxia
 - Ventilation-perfusion abnormalities
 - Shunting
- Acute respiratory failure
- Pulmonary edema
 - Excess water in the lungs



Conditions Caused by Pulmonary Disease or Injury

- Aspiration
 - Passage of fluid and solid particles into the lungs
- Atelectasis
 - Compression atelectasis
 - Absorption atelectasis
- Bronchiectasis
 - Persistent abnormal dilation of the bronchi
 - Cylindrical, saccular, and varicose



Conditions Caused by Pulmonary Disease or Injury

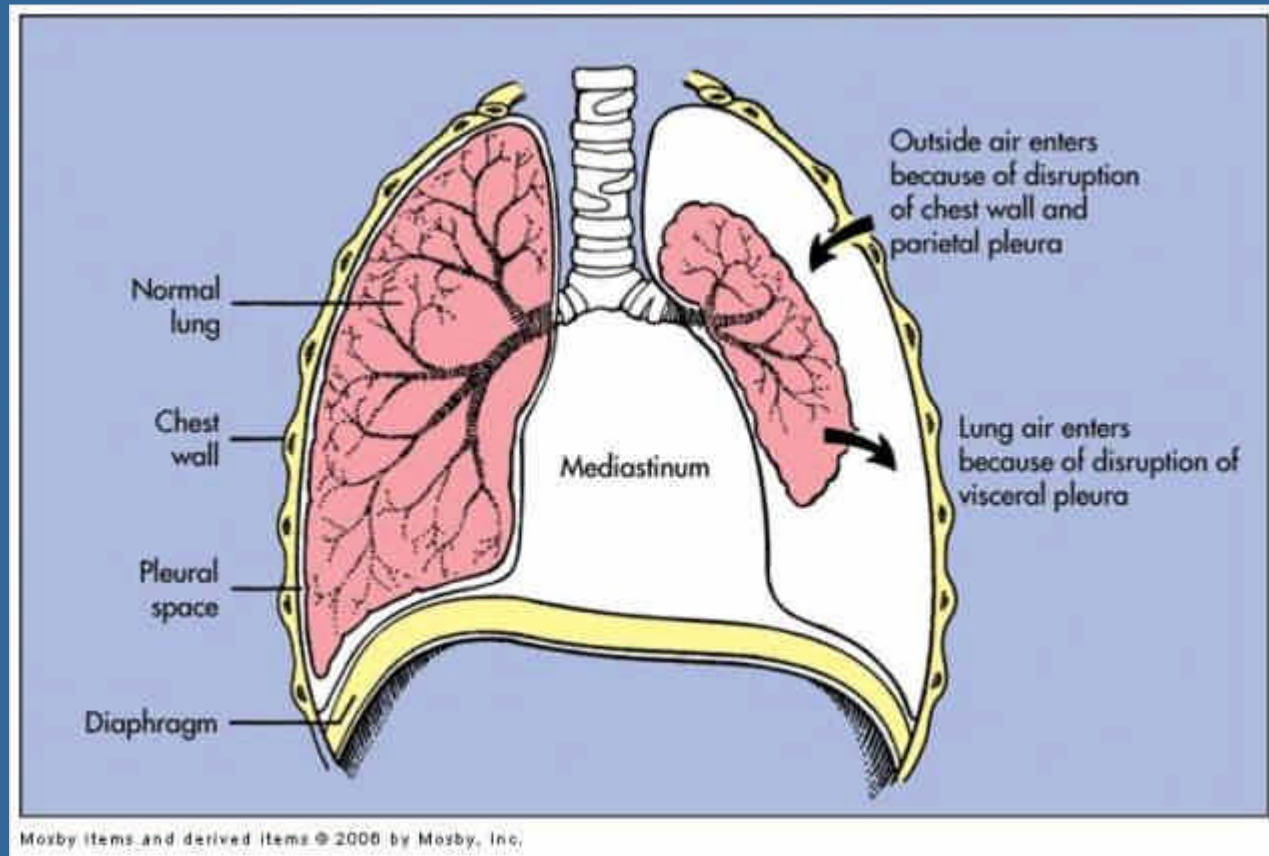
- Bronchiolitis
 - Inflammatory obstruction of the small airways
 - Most common in children
 - Occurs in adults with chronic bronchitis, in association with a viral infection, or with inhalation of toxic gases
- Bronchiolitis obliterans
 - Late-stage fibrotic disease of the airways
 - Can occur with all causes of bronchiolitis



Pleural Abnormalities

- Pneumothorax
 - Open pneumothorax
 - Tension pneumothorax
 - Spontaneous pneumothorax
 - Secondary pneumothorax

Pneumothorax





Pleural Abnormalities

- Pleural effusion
 - Transudative effusion
 - Exudative effusion
 - Pleurisy
 - Hemothorax
- Empyema
 - Infected pleural effusion



Pulmonary Disorders

- Acute respiratory distress syndrome (ARDS)
 - Fulminant form of respiratory failure characterized by acute lung inflammation and diffuse alveolocapillary injury
 - Injury to the pulmonary capillary endothelium
 - Inflammation and platelet activation
 - Surfactant inactivation
 - Atelectasis

An abstract painting of a human face, rendered in a style reminiscent of Vincent van Gogh's 'Olympia'. The face is composed of various textured brushstrokes in shades of blue, green, yellow, and brown. The eyes are particularly prominent, with a mix of blue and white tones. The overall composition is dynamic and expressive.

Pulmonary Disorders

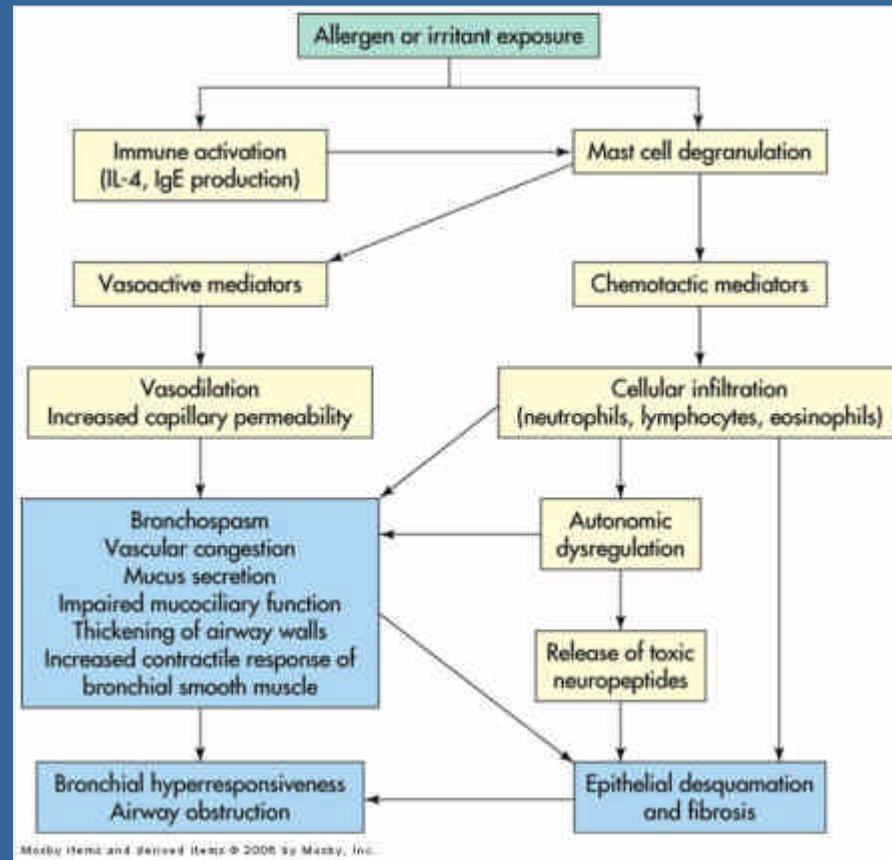
- Postoperative respiratory failure
 - Atelectasis
 - Pneumonia
 - Pulmonary edema
 - Pulmonary emboli
 - Prevention
 - Frequent turning, deep breathing, early ambulation, air humidification, and incentive spirometry



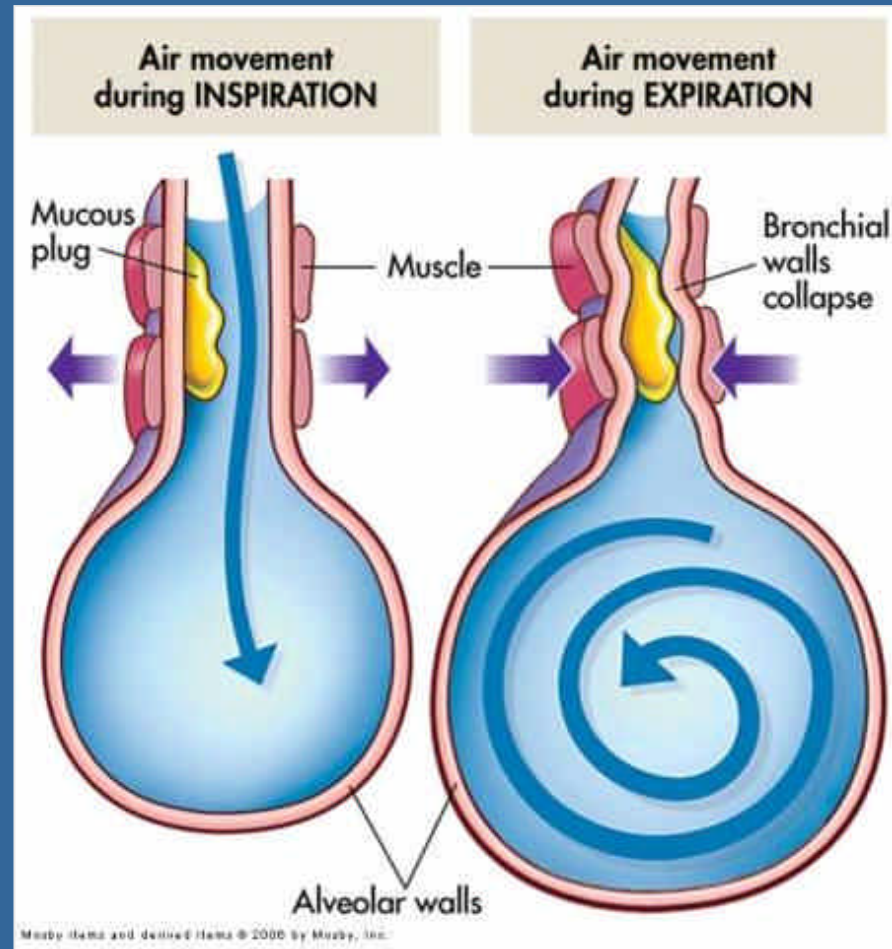
Obstructive Pulmonary Disease

- Airway obstruction that is worse with expiration
- Common signs and symptoms
 - Dyspnea and wheezing
- Common obstructive disorders
 - Asthma
 - Emphysema
 - Chronic bronchitis

Asthma



Chronic Obstructive Pulmonary Disease





Chronic Obstructive Pulmonary Disease

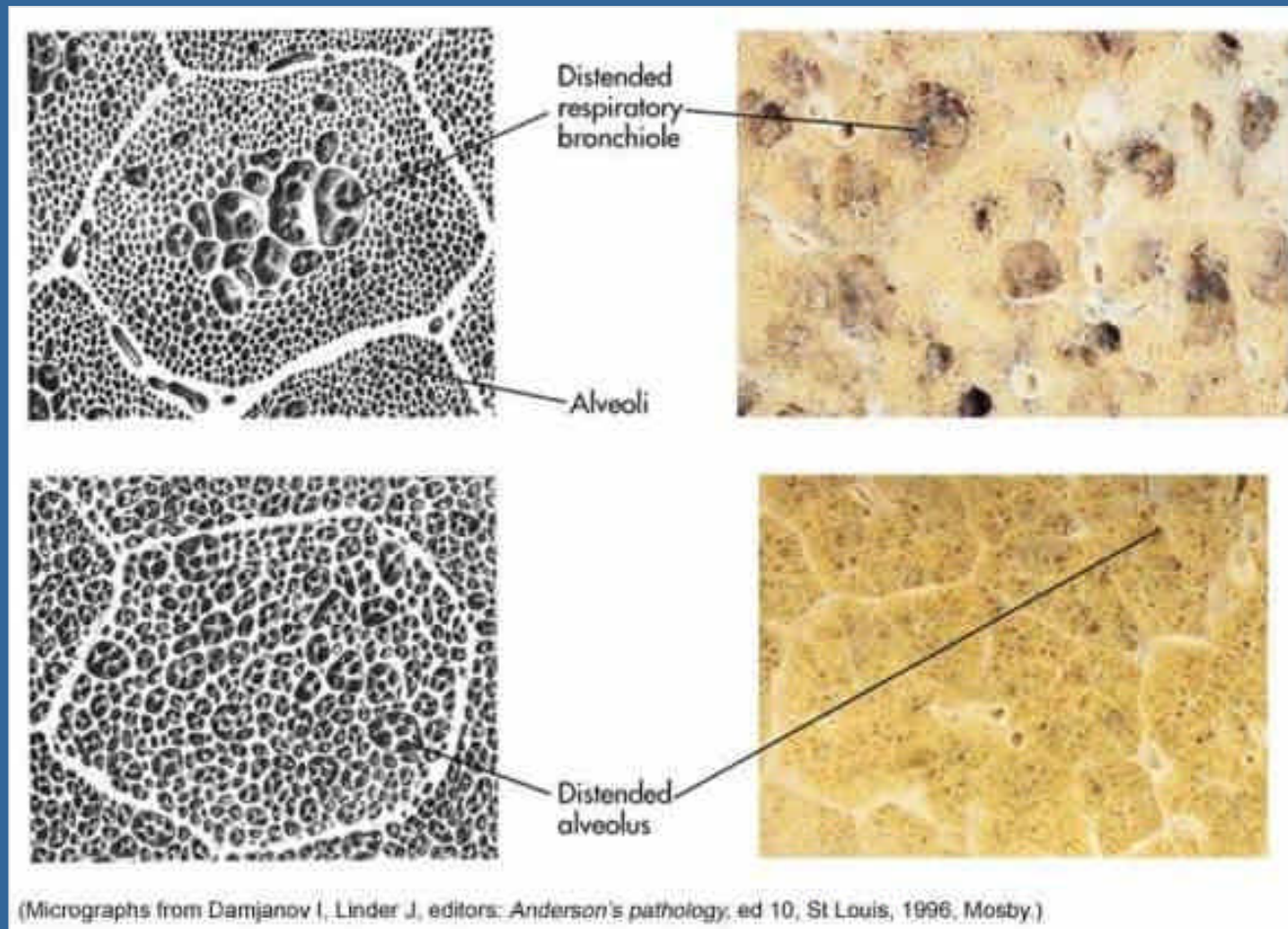
- Chronic bronchitis
 - Hypersecretion of mucus and chronic productive cough that lasts for at least 3 months of the year and for at least 2 consecutive years
 - Inspired irritants increase mucus production and the size and number of mucous glands
 - The mucus is thicker than normal



Chronic Obstructive Pulmonary Disease

- Emphysema
 - Abnormal permanent enlargement of the gas-exchange airways accompanied by destruction of alveolar walls without obvious fibrosis
 - Loss of elastic recoil
 - Centriacinar emphysema
 - Panacinar emphysema

Emphysema

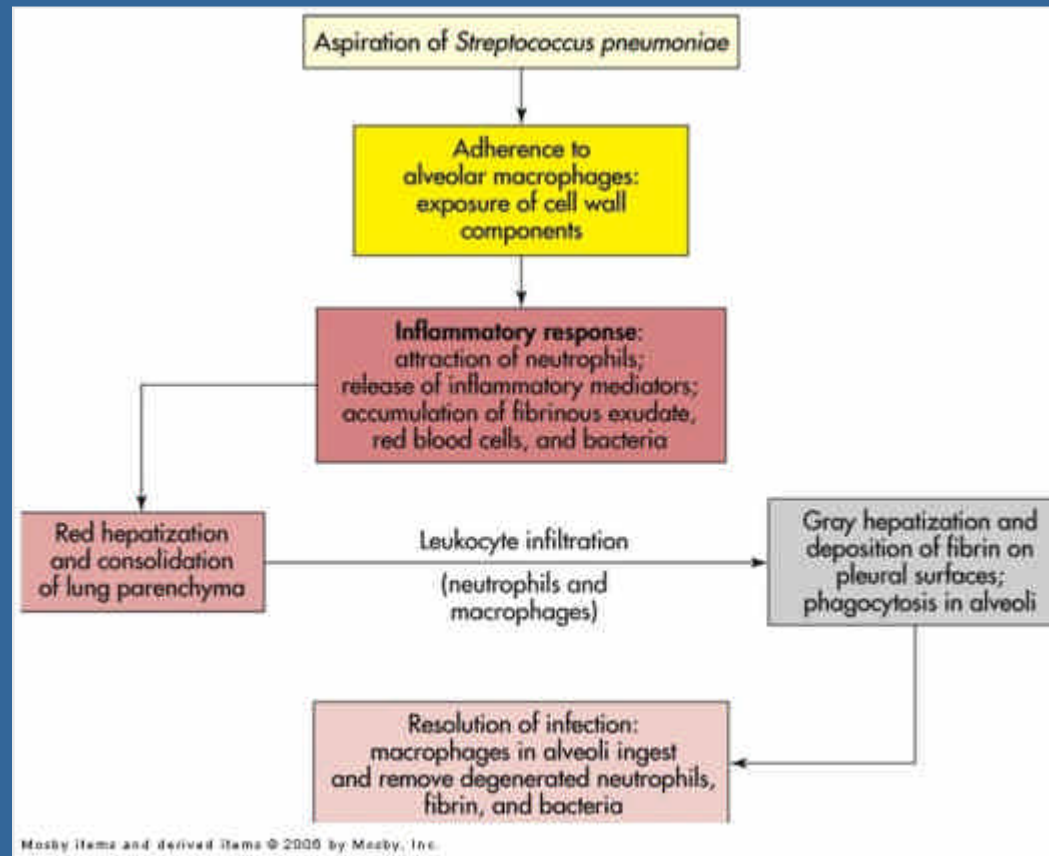




Respiratory Tract Infections

- Pneumonia
 - Community-acquired pneumonia
 - *Streptococcus pneumoniae*
 - Hospital-acquired (nosocomial) pneumonia
 - Pneumococcal pneumonia
 - Viral pneumonia

Pneumococcal Pneumonia





Respiratory Tract Infections

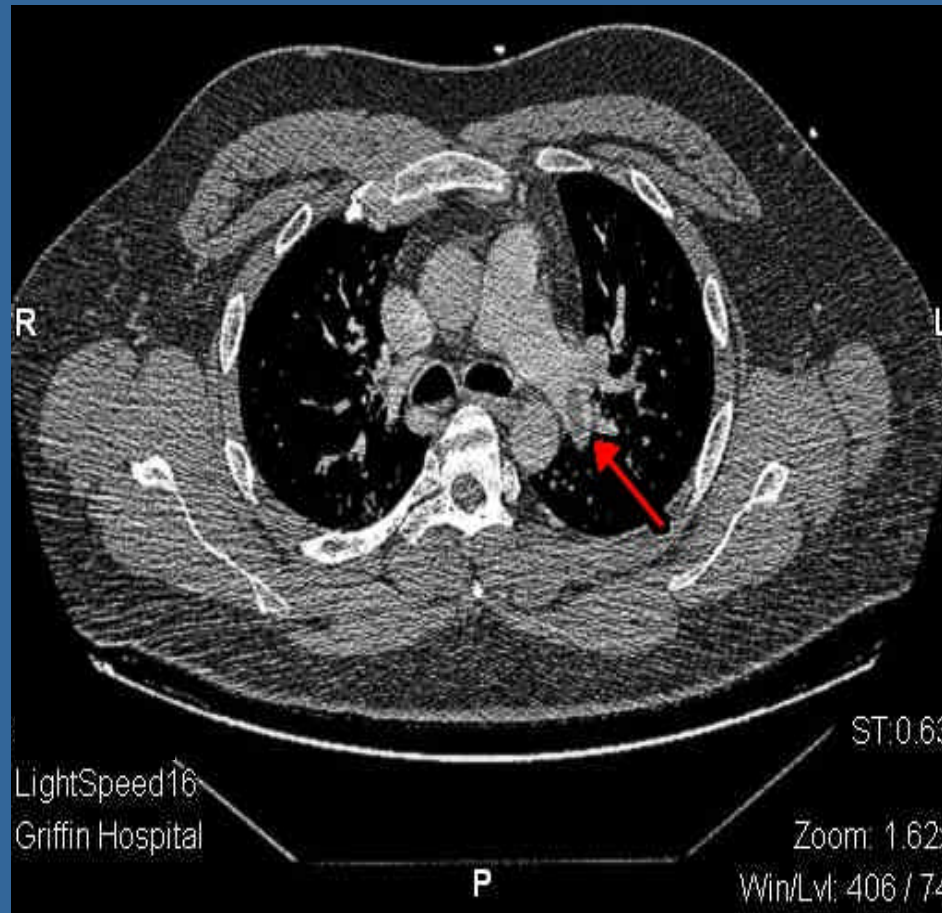
- Acute bronchitis
 - Acute infection or inflammation of the airways or bronchi
 - Commonly follows a viral illness
 - Acute bronchitis causes similar symptoms to pneumonia but does not demonstrate pulmonary consolidation and chest infiltrates



Pulmonary Vascular Disease

- Pulmonary embolism
 - Occlusion of a portion of the pulmonary vascular bed by a thrombus, embolus, tissue fragment, lipids, or an air bubble
 - Pulmonary emboli commonly arise from the deep veins in the thigh
 - Virchow triad
 - Venous stasis, hypercoagulability, and injuries to the endothelial cells that line the vessels

Pulmonary Embolism





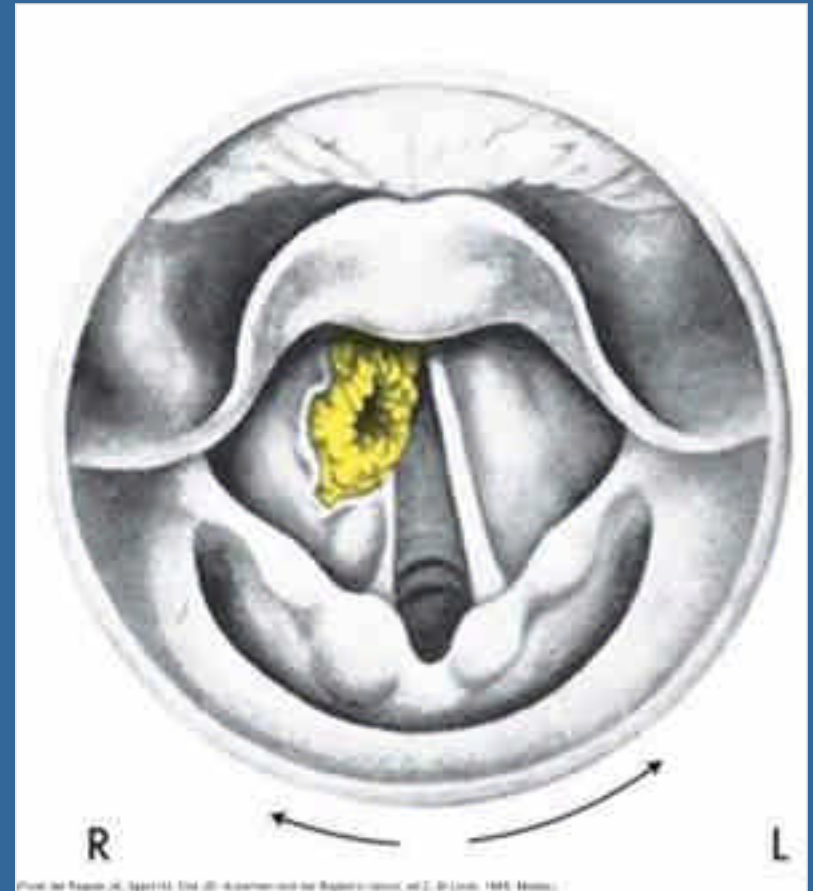
Cancer

- Lip cancer
 - Most common form
 - Exophytic
 - Stages
- Laryngeal cancer
 - Forms
 - Carcinoma of the true vocal cords (most common)
 - Supraglottic
 - Subglottic

Lip and Laryngeal Cancer



(From del Regato JA, Sippitt HJ, Cole JD, Ackerman and del Regato's cancer, ed 2, St Louis, 1985, Mosby)



(From del Regato JA, Sippitt HJ, Cole JD, Ackerman and del Regato's cancer, ed 2, St Louis, 1985, Mosby)



Lung Cancer

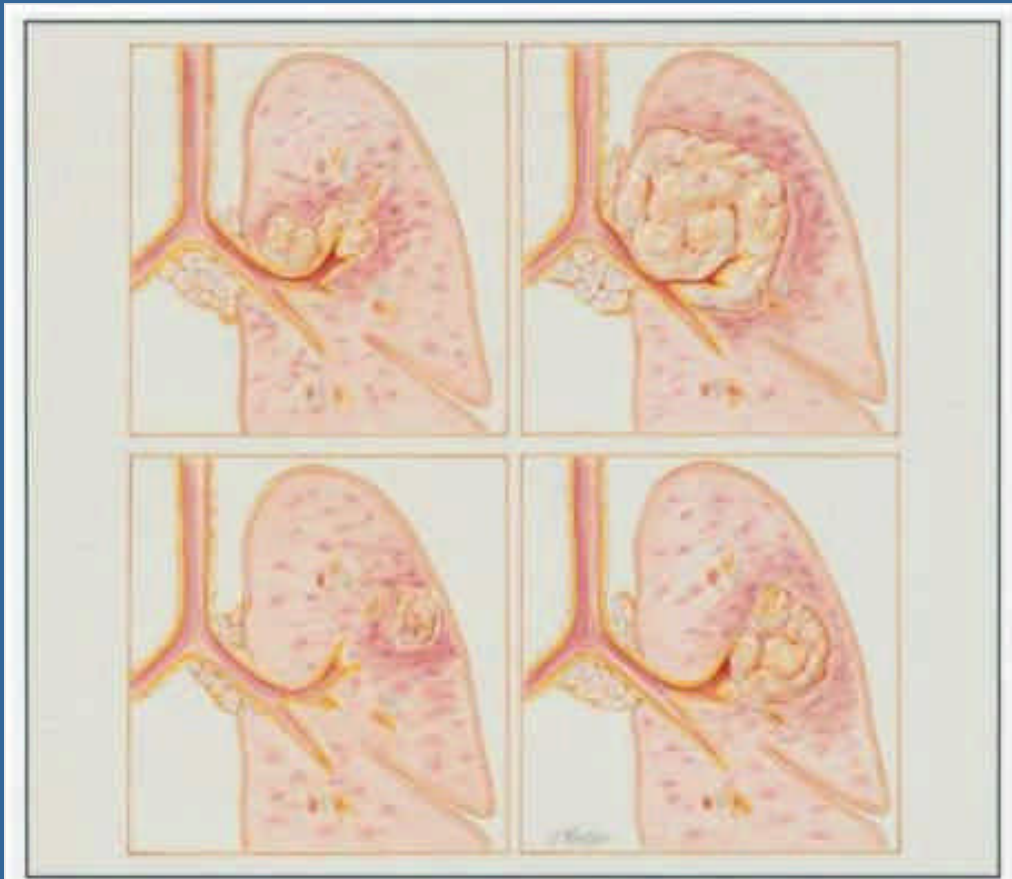
- Bronchogenic carcinomas
- Most common cause is cigarette smoking
 - Heavy smokers have a 20 times greater chance of developing lung cancer than nonsmokers
 - Smoking is related to cancers of the larynx, oral cavity, esophagus, and urinary bladder
- Environmental or occupational risk factors are also associated with lung cancer



Lung Cancer

- Non–small cell lung cancer
 - Squamous cell carcinoma
 - Adenocarcinoma
- Large cell carcinoma (undifferentiated)
- Small cell carcinoma

Lung Cancer



(From Des Jardins T, Burton GG: *Clinical manifestations and assessment of respiratory disease*, ed 3, St Louis, 1985, Mosby.)



Other Lung Cancers

- Bronchial carcinoid tumors
- Adenocystic tumors (cylindromas)
- Mucoepidermoid carcinomas
- Mesotheliomas

An abstract painting of a human face, rendered in a cubist style with bold colors and geometric shapes. The face is composed of various shades of blue, green, yellow, and brown, with a textured, stippled appearance. The eyes are dark and prominent, and the overall composition is dynamic and expressive.

Symptoms of OSA

- Result from disruption of normal sleep architecture
- Frequent arousals and inability to achieve or maintain deeper stages of sleep
 - Excessive daytime sleepiness
 - Poor sleep quality
 - Automobile accidents
 - Personality changes
 - Memory disturbances
 - Erectile dysfunction
 - Depression



Might you have sleep apnea?

- Do you snore?
- Excessively tired during the day?
- Wake during sleep feeling breathless?
- Stop breathing during sleep?
- History of hypertension
- Difficulty falling or staying asleep?
- Restless legs?

“Yes” to 2 or more is indication for PSG