

# The Respiratory System

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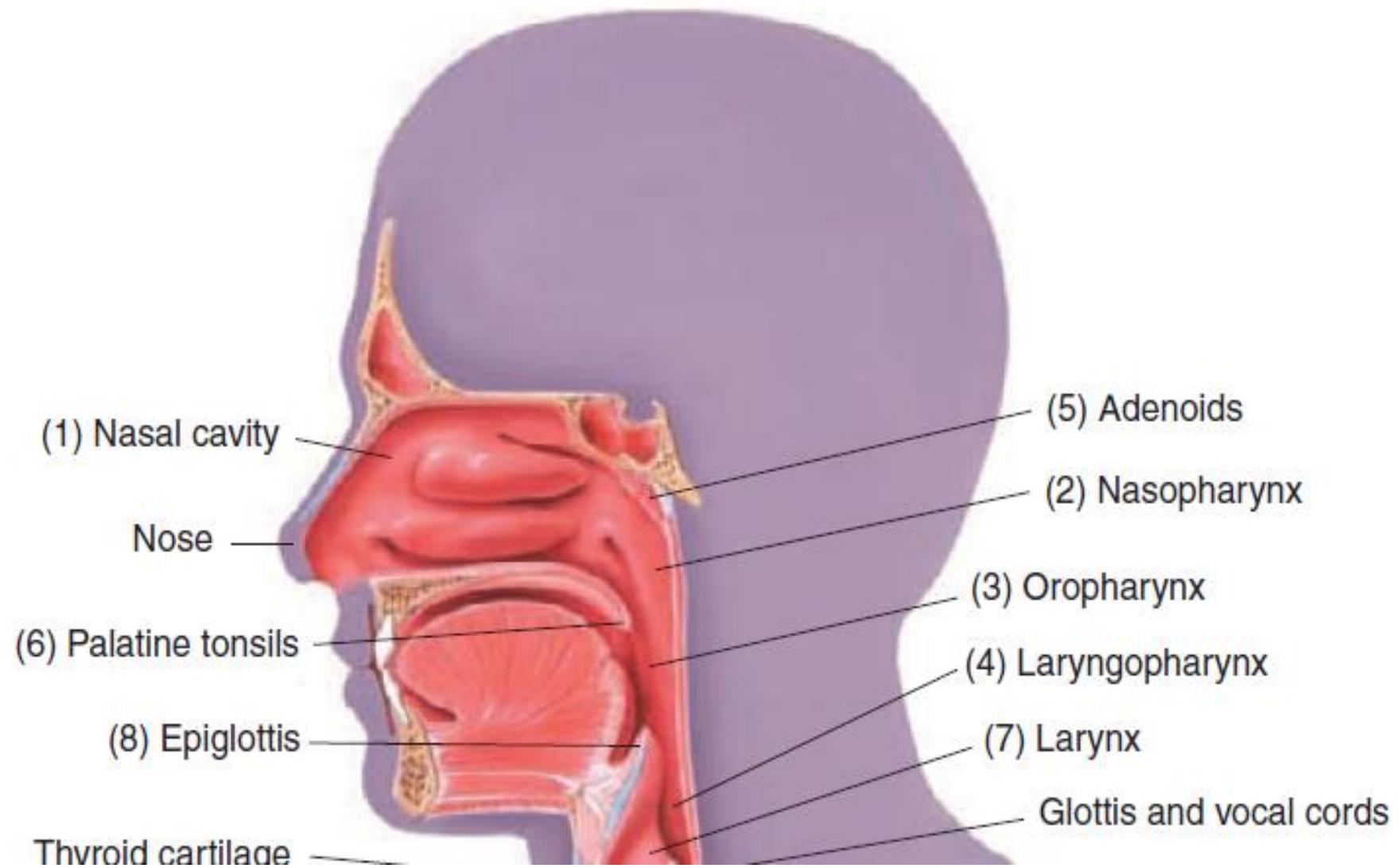


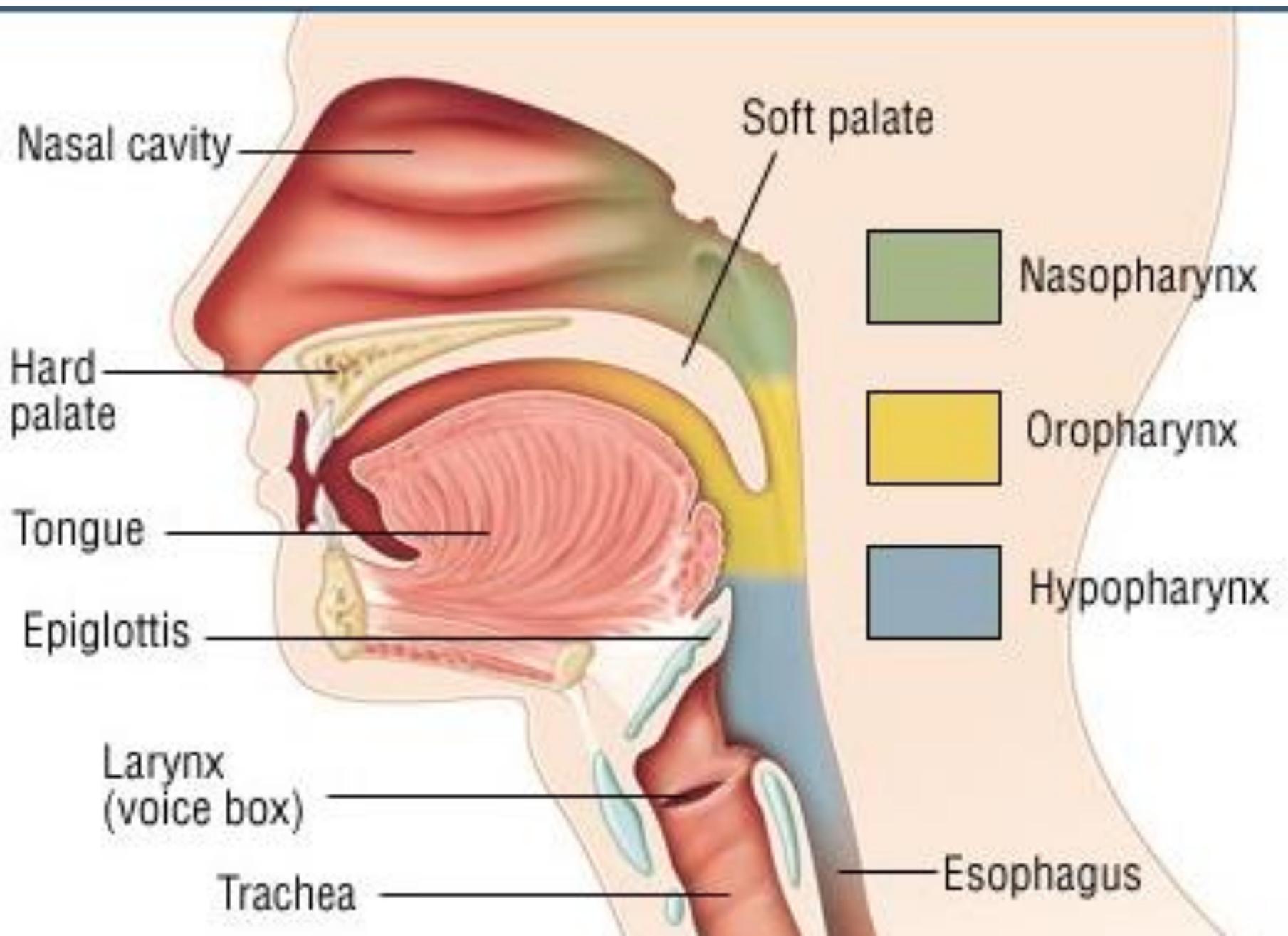
# Anatomy and physiology

- The respiratory system is responsible for the exchange of **oxygen** (O<sub>2</sub>) and **carbon dioxide** (CO<sub>2</sub>).
- The lungs and airways bring in fresh, oxygenenriched air and expel waste CO<sub>2</sub> by a process called ***breathing***, or ***ventilation***. Breathing helps regulate the **pH** (acidity-alkalinity) of the blood, thereby maintaining homeostasis.

# Upper respiratory tract

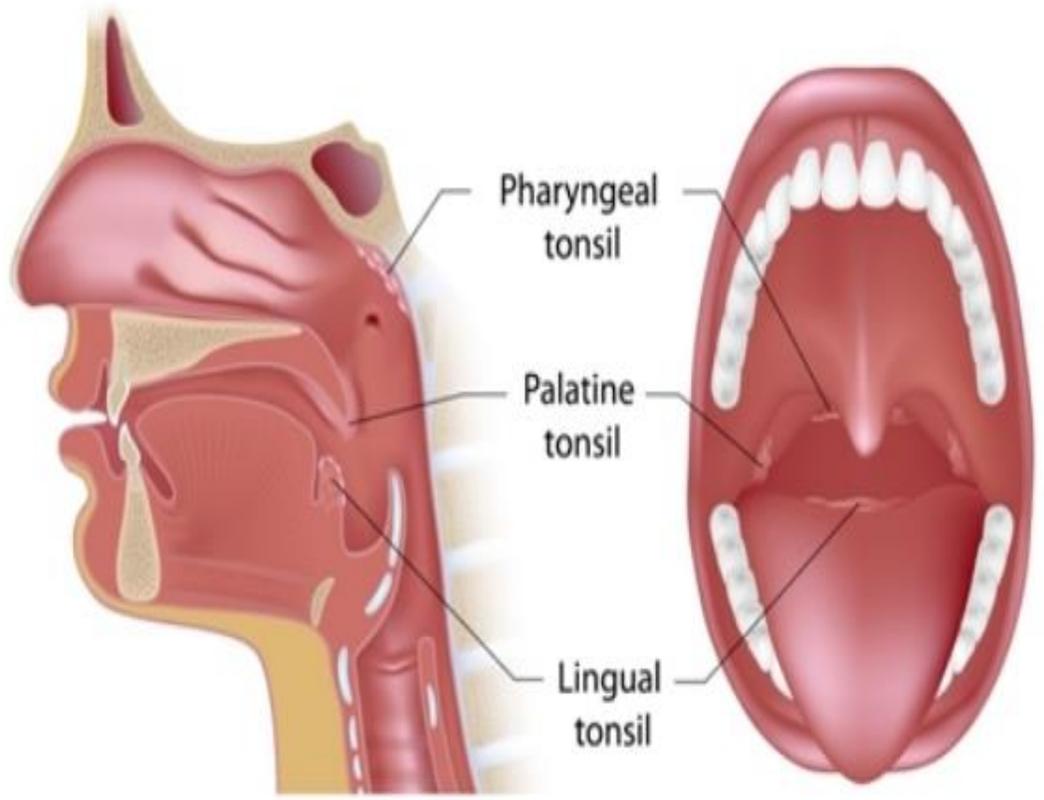
- The breathing process: begins with inhalation. Air is drawn into the (1) **nasal cavity**, a chamber lined with mucous membranes and tiny hairs called ***cilia*** (singular, ***cilium***). Here, air is filtered, heated, and moistened to prepare it for its journey to the lungs.
- The nasal cavity is divided into a right and left side by a vertical partition of **cartilage** called the ***nasal septum***.
- Air passes from the nasal cavity to the throat (**pharynx**), a muscular tube that serves as a passageway for food and air.
- The pharynx consists of three sections: the (2) **nasopharynx**, posterior to the nose; the (3) **oropharynx**, posterior to the mouth; and the (4) **laryngopharynx**, superior to the larynx





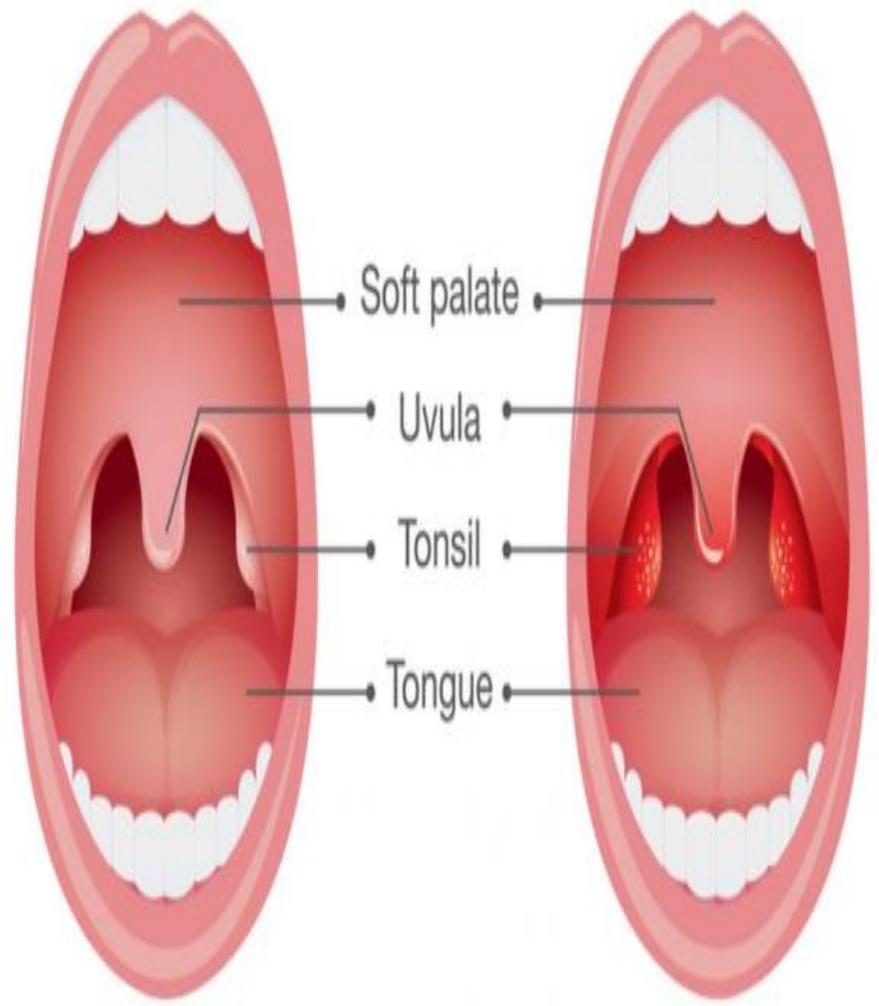
# Upper respiratory tract

- Within the nasopharynx is a collection of lymphoid tissue known as (5) **adenoids** (pharyngeal tonsils). The (6) **palatine tonsils**, more commonly known as **tonsils**, are located in the oropharynx. They protect the opening to the respiratory tract from microscopic organisms that may attempt entry by this route.
- The (7) **larynx** (voice box) contains the structures that make vocal sounds possible. A leaf-shaped structure on top of the larynx, the (8) **epiglottis**, seals off the air passage to the lungs during swallowing. This function ensures that food or liquids do not obstruct the flow of air to the lungs. The larynx is a short passage that joins the pharynx with the (9) **trachea** (windpipe).



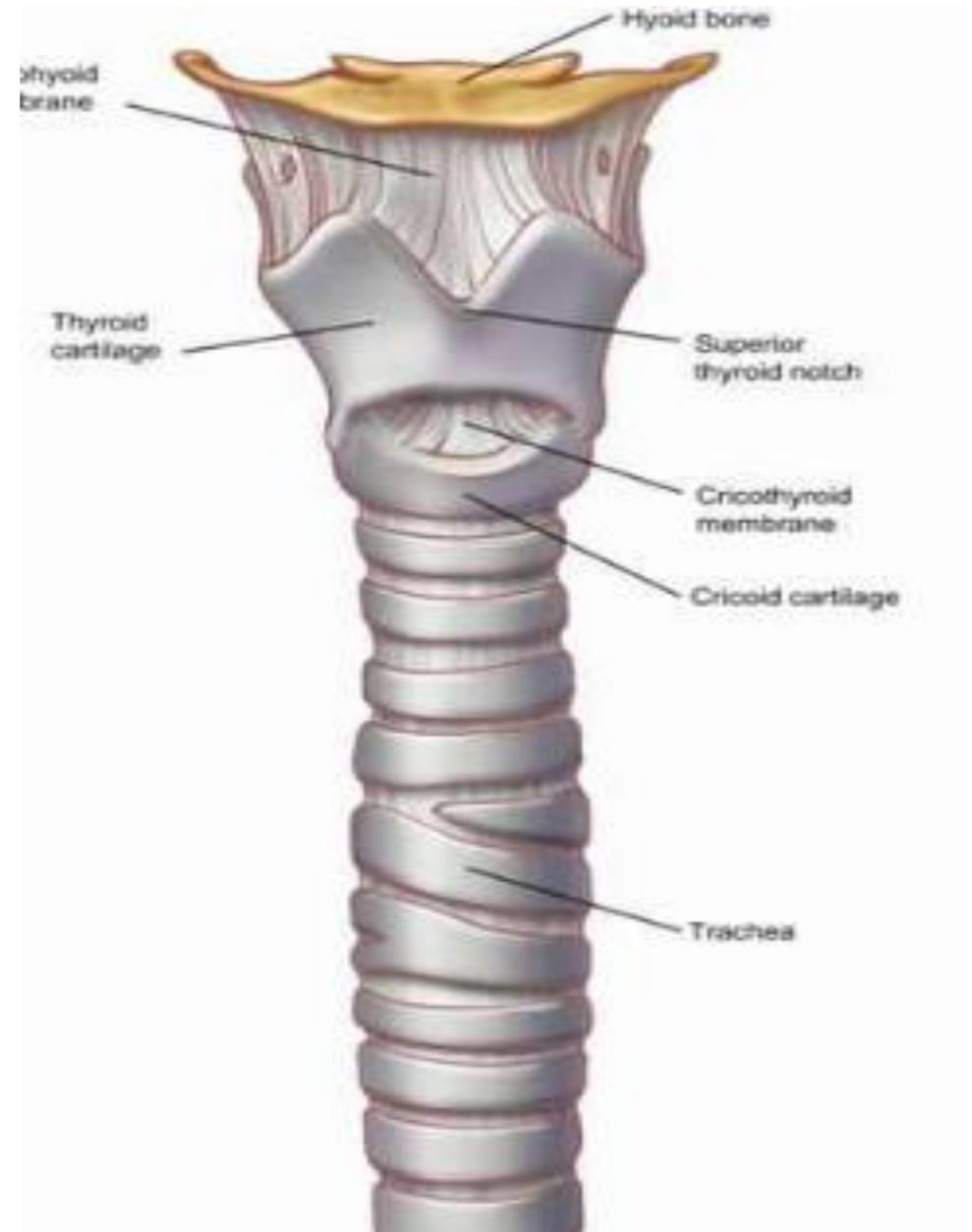
Normal tonsils

Inflamed tonsils



# Upper respiratory tract

- The trachea is composed of smooth muscle embedded with C-shaped rings of cartilage, which provide rigidity to keep the air passage open.



# Lower respiratory tract

- The trachea divides into two branches called (10) bronchi (singular, bronchus). One branch leads to the (11) right lung and the other to the (12) left lung.
- The inner walls of the trachea and bronchi are composed of mucous membrane (mucosa) embedded with cilia. This membrane traps incoming particles, and the cilia move the entrapped material upward into the pharynx, where it is coughed out, sneezed out, or swallowed. Like the trachea, bronchi contain C-shaped rings of cartilage.

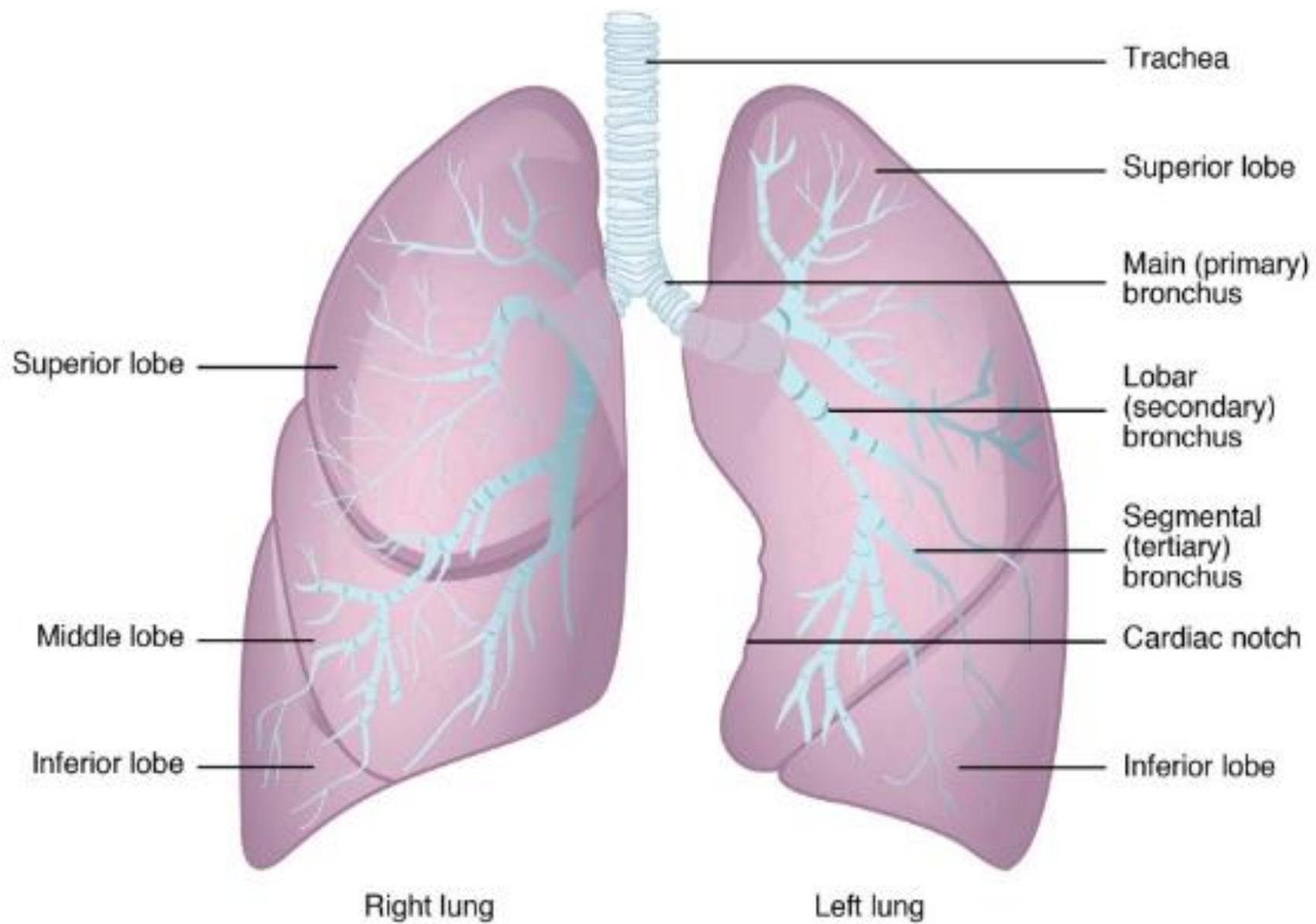
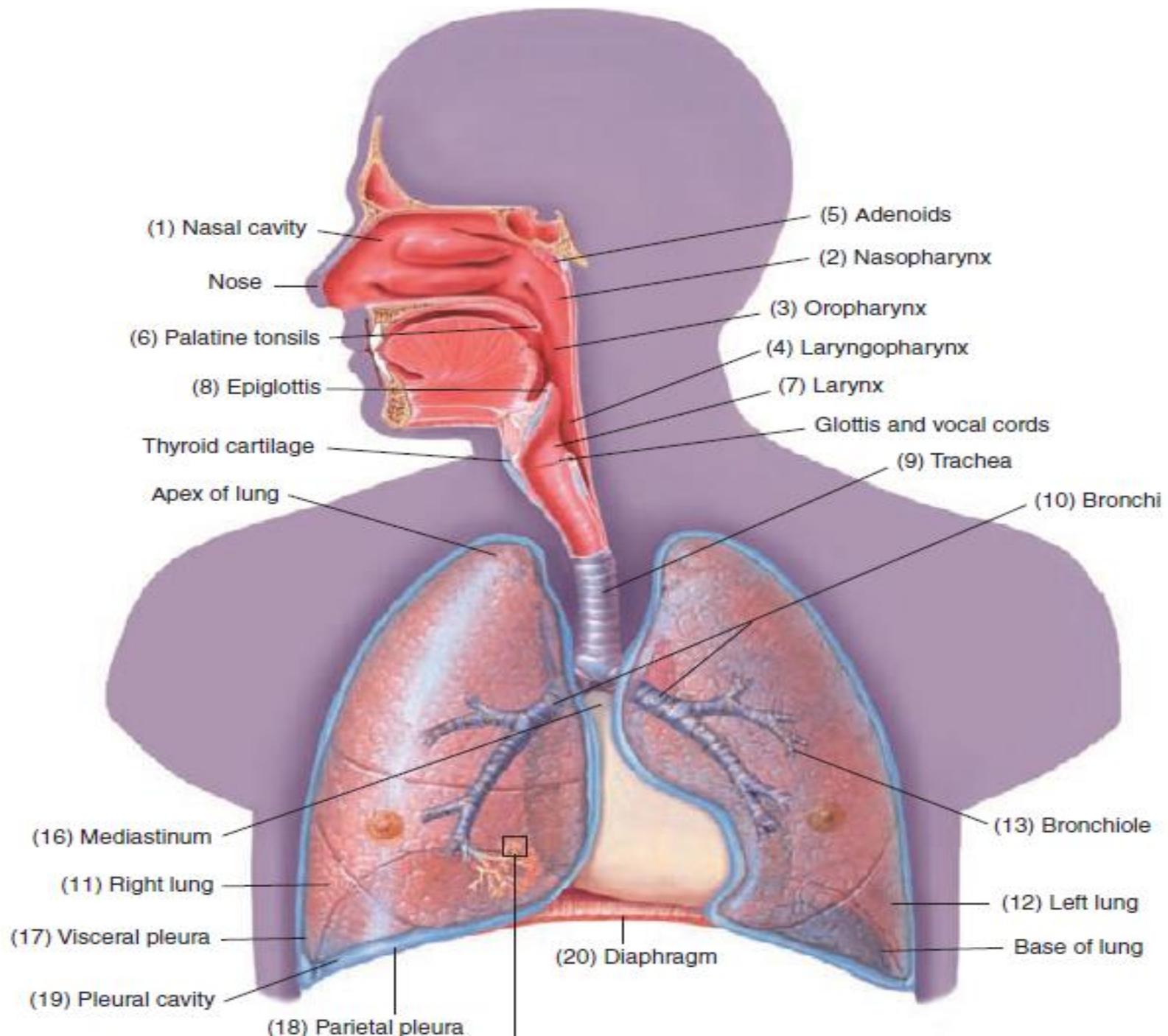


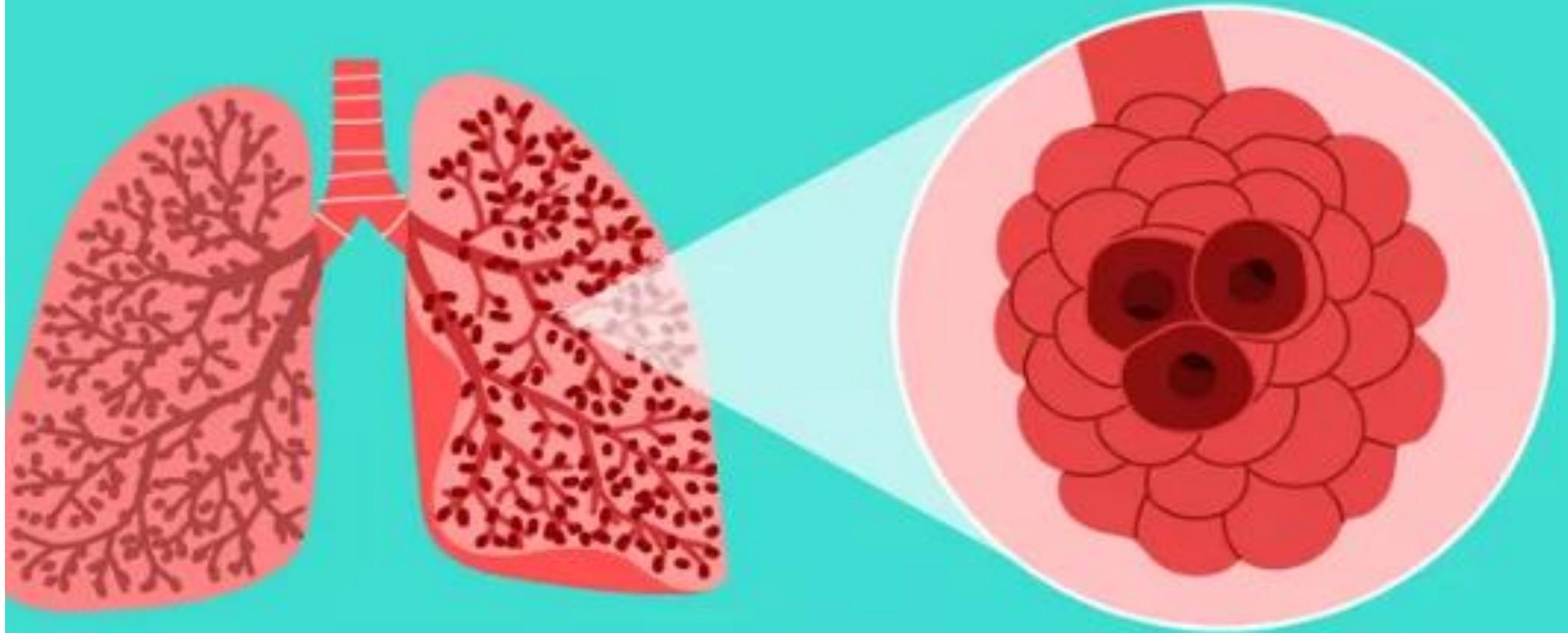
Figure 1. Gross Anatomy of the Lungs

# Lower respiratory tract

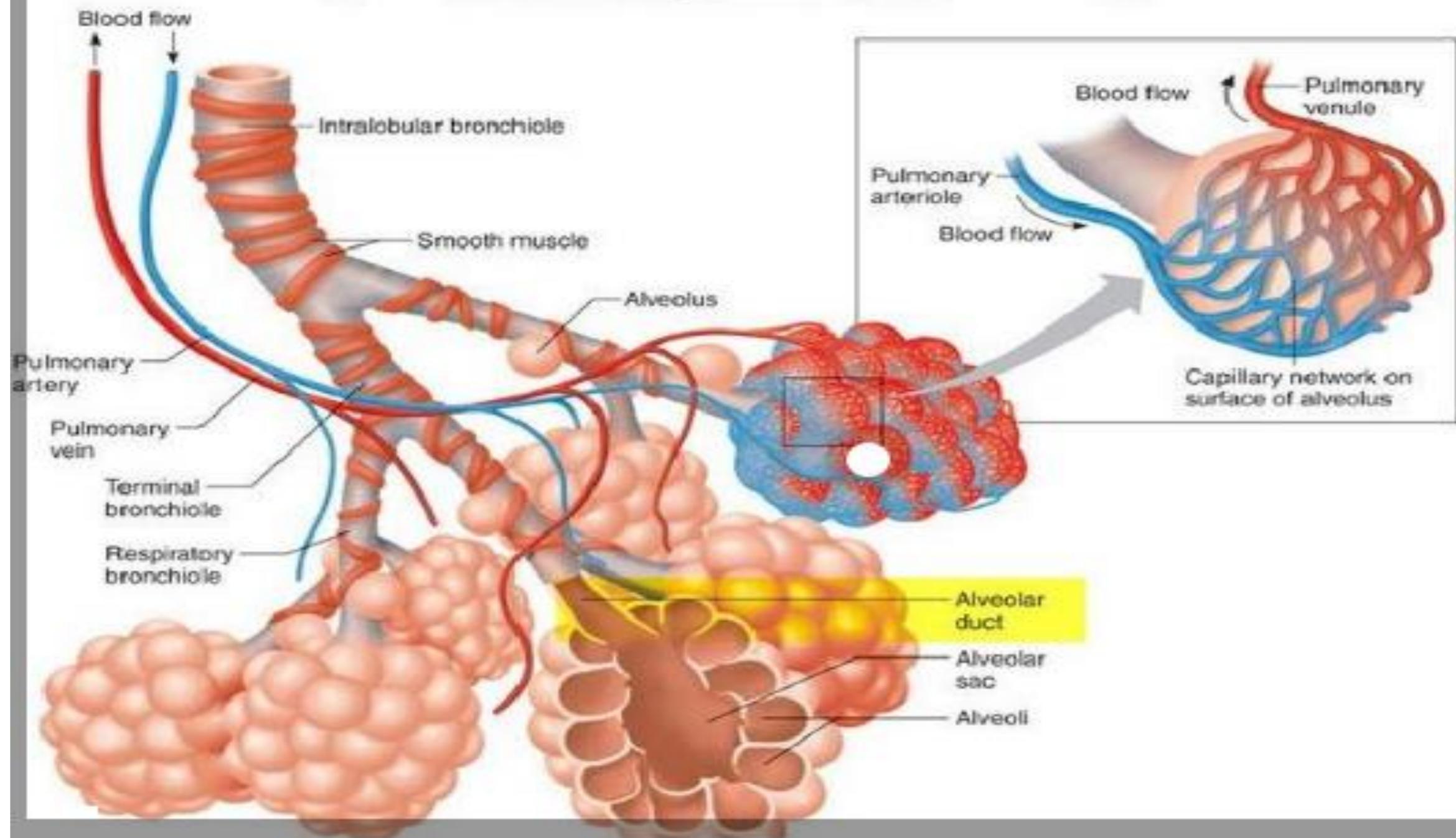
- Each bronchus divides into smaller and smaller branches, eventually forming (13) **bronchioles**. At the end of the bronchioles are tiny air sacs called (14) **alveoli** (singular, *alveolus*). An alveolus resembles a small balloon because it expands and contracts with inflow and outflow of air. The (15) **pulmonary capillaries** lie next to the thin tissue membranes of the alveoli.
- Carbon dioxide **diffuses** from the blood within the pulmonary capillaries and enters the alveolar spaces, while O<sub>2</sub> from the alveoli diffuses into the blood. After the exchange of gases, freshly oxygenated blood returns to the heart. It is now ready for delivery to all body tissues.



# What Are Alveoli?

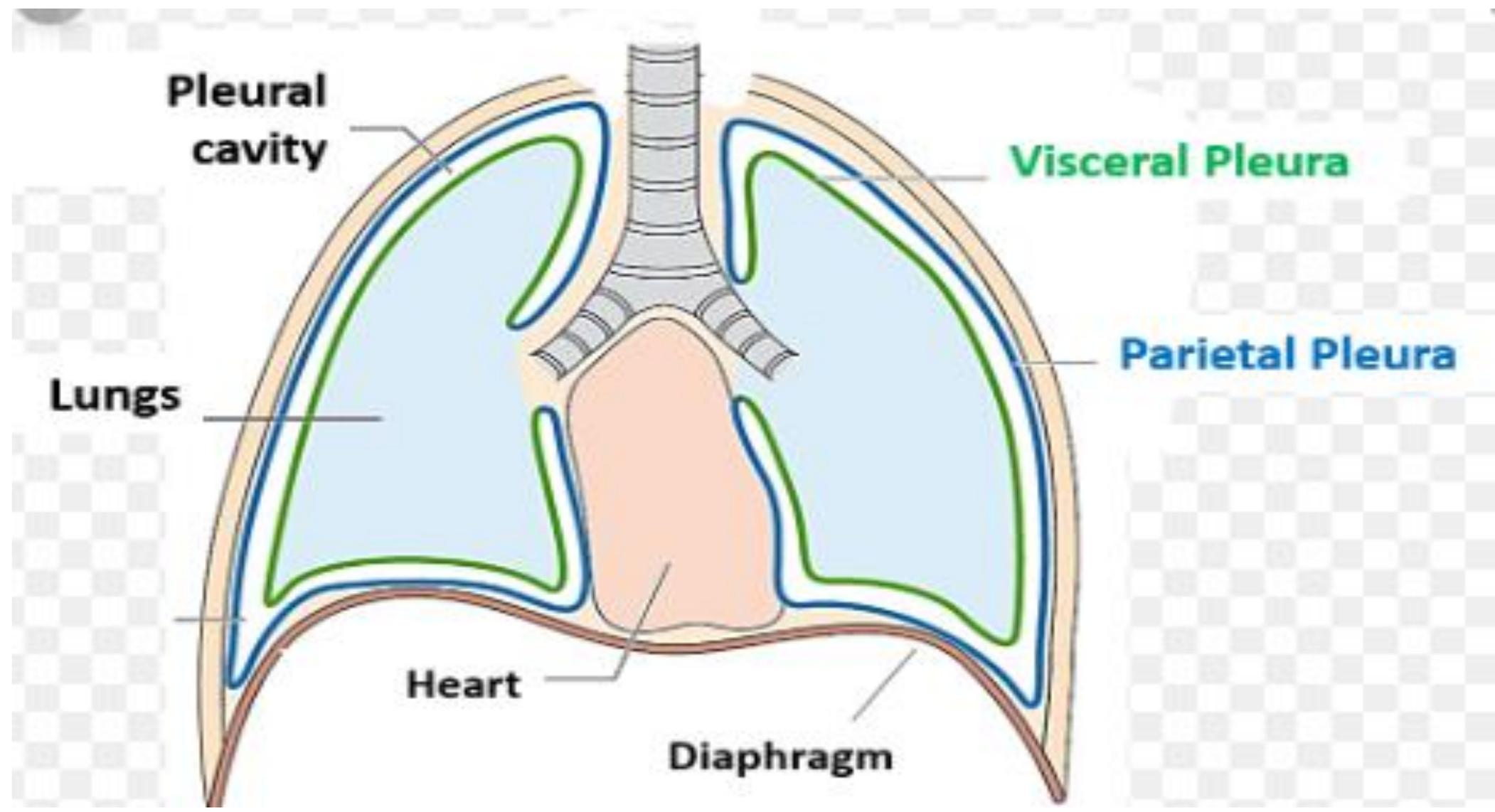


- **Endpoint of the respiratory system**
- **Exchange oxygen and carbon dioxide in the bloodstream**



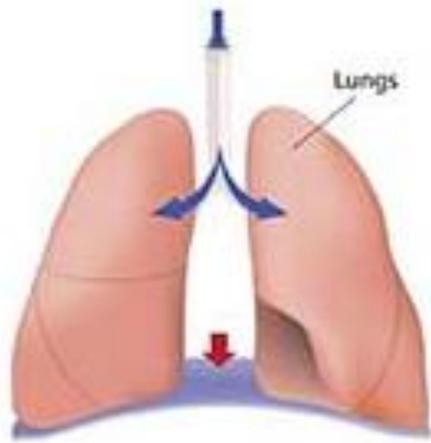
# Lower respiratory tract

- The lungs are divided into lobes: three lobes in the right lung and two lobes in the left lung. The space between the right and left lungs is called the (16) **mediastinum**. It contains the heart, aorta, esophagus, and bronchi. A **serous membrane**, the **pleura**, covers the lobes of the lungs and folds over to line the walls of the thoracic cavity.
- The membrane lying closest to the lung is the (17) **visceral pleura**; the membrane that lines the thoracic cavity is the (18) **parietal pleura**. The space between these two membranes is the (19) **pleural cavity**. It contains a small amount of lubricating fluid, which permits the visceral pleura to glide smoothly over the parietal pleura during breathing.

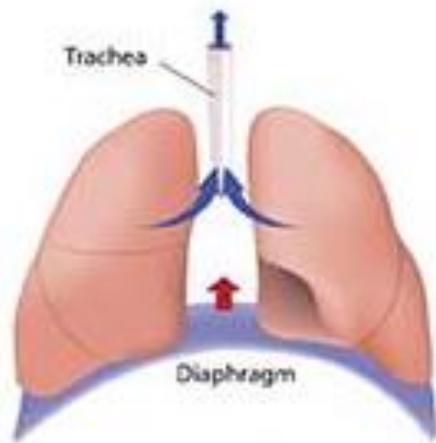


# Lower respiratory tract

- the (20) **diaphragm**, lies between the chest and abdominal cavities. The diaphragm assists in changing the volume of the thoracic cavity to produce the needed pressure differential for ventilation. When the diaphragm contracts, it partially descends into the abdominal cavity, thus decreasing the pressure within the chest and drawing air into the lungs (**inspiration**).
- When the diaphragm relaxes, it slowly reenters the thoracic cavity, thus increasing the pressure within the chest. As the pressure increases, air leaves the lungs (**expiration**).
- The intercostal muscles assist the diaphragm in changing the volume of the thoracic cavity by elevating and lowering the rib cage.



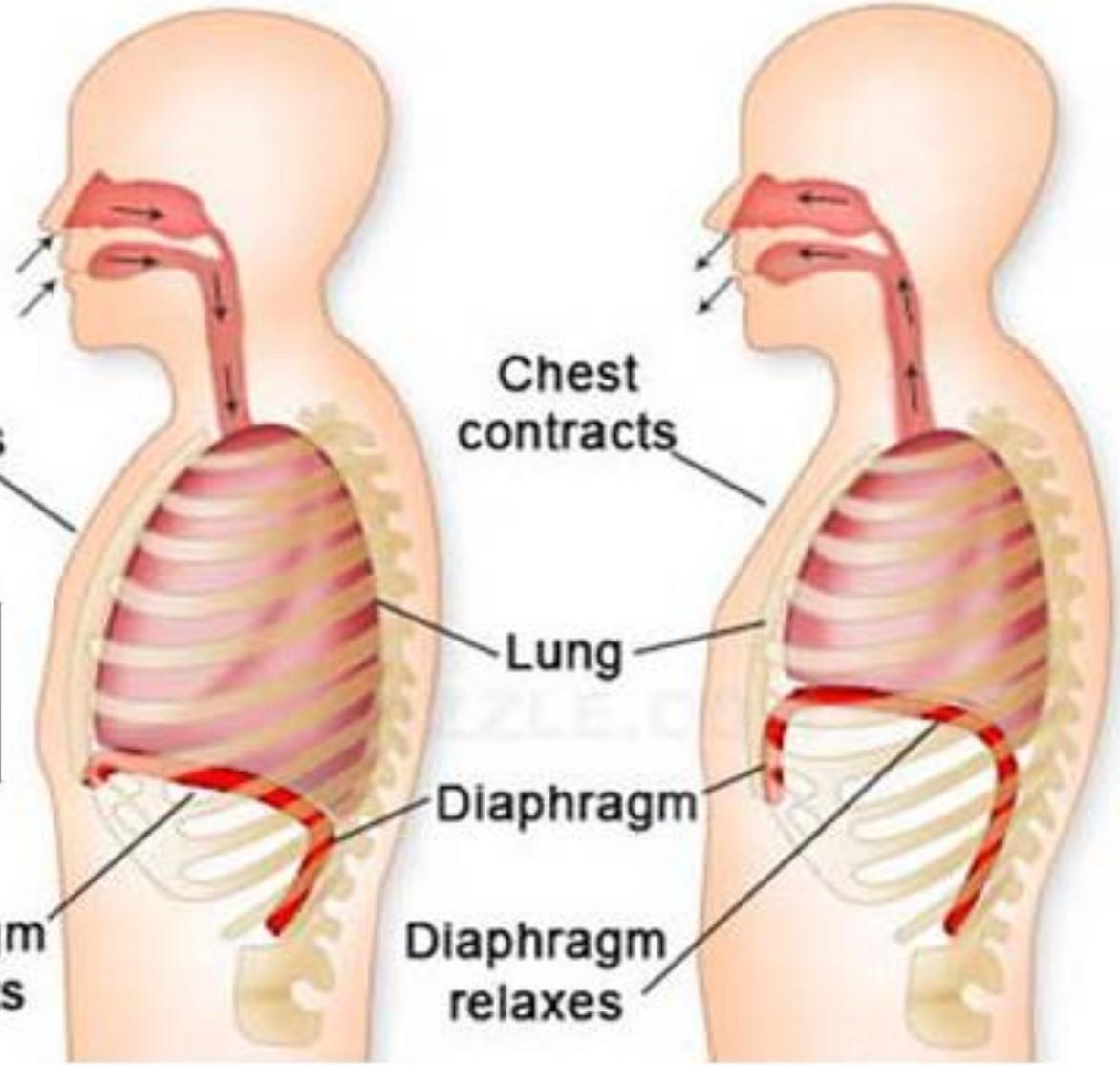
Breath



Exhalation

Inhale

Exhale



**WHAT IS THE FUNCTION OF  
DIAPHRAGM IN BREATHING**

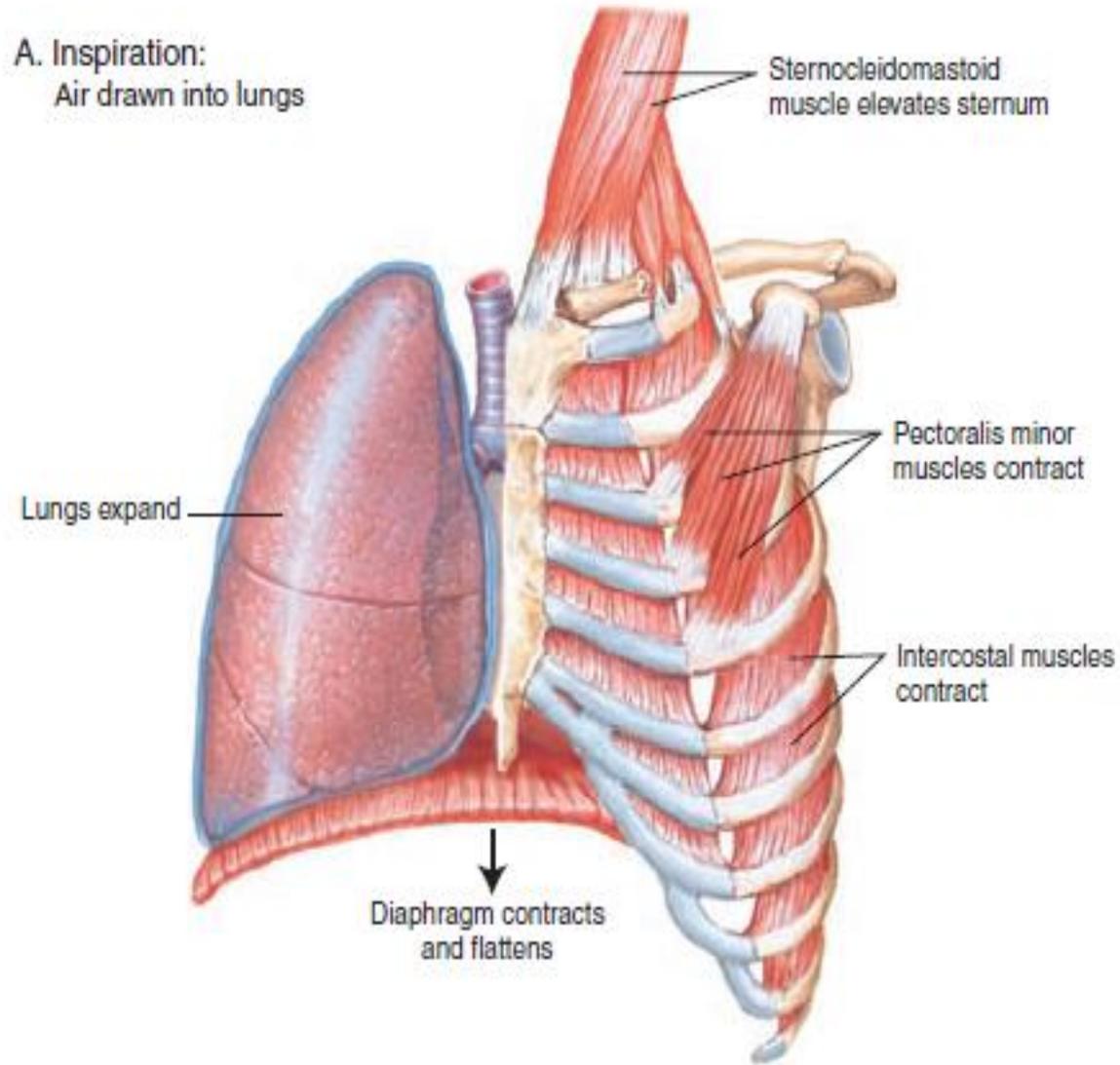
# Respiration

- Respiration is the overall process by which O<sub>2</sub> is taken from air and carried to body cells for their use, while CO<sub>2</sub> and water, the waste products generated by these cells, are returned to the environment.
- Respiration includes four separate processes:
  1. **pulmonary ventilation**, more commonly called *breathing*, which is a largely involuntary action that moves air into (**inspiration**) and out of (**expiration**) the lungs in response to changes in blood O<sub>2</sub> and CO<sub>2</sub> levels and nervous stimulation of the diaphragm and intercostal muscles

# Respiration

- 2. external respiration**, which is the exchange of oxygen and carbon dioxide between the alveoli and the blood in the pulmonary capillaries.
- 3. transport of respiratory gases**, which occurs when blood, aided by the cardiovascular system, transports CO<sub>2</sub> to the lungs and O<sub>2</sub> to body cells
- 4. internal respiration**, which is the exchange of O<sub>2</sub> and CO<sub>2</sub> between body cells and the blood in systemic capillaries.

A. Inspiration:  
Air drawn into lungs



B. Expiration:  
Air forced out of lungs

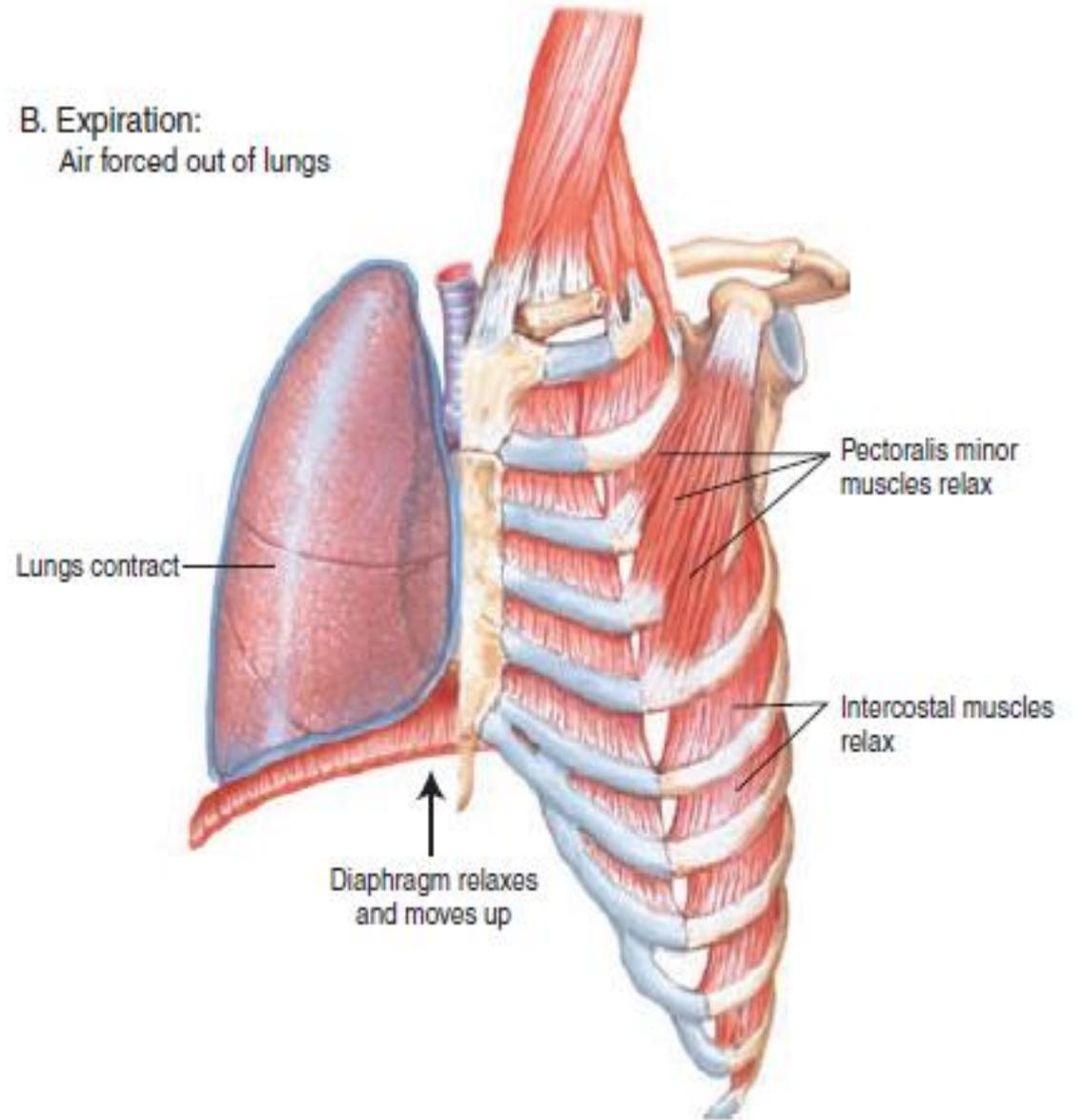


Figure 7-2. Breathing muscles.

Element	Meaning	Word Analysis
<i>Combining Forms</i>		
<b>Upper Respiratory Tract</b>		
nas/o	nose	<b>nas/al</b> (NĀ-zl): pertaining to the nose -al: pertaining to
rhin/o		<b>rhin/o/plasty</b> (RĪ-nō-plās-tē): surgical repair of the nose -plasty: surgical repair <i>Rhinoplasty is performed to correct birth defects or for cosmetic purposes.</i>
sept/o	septum	<b>sept/o/plasty</b> (SĔP-tō-plās-tē): surgical repair of the septum -plasty: surgical repair <i>Septoplasty is commonly performed to correct a deviated septum.</i>
sinus/o	sinus, cavity	<b>sinus/o/tomy</b> (sī-nūs-ŌT-ō-mē): incision of any of the sinuses -tomy: incision <i>Sinusotomy is performed to improve ventilation or drainage in unresponsive sinusitis.</i>
adenoid/o	adenoids	<b>adenoid/ectomy</b> (ăd-ě-noyd-ĔK-tō-mē): excision of adenoids -ectomy: excision, removal

Element	Meaning	Word Analysis
tonsill/o	tonsils	peri/ <b>tonsill</b> /ar (pĕr-ĭ-TŌN-sĭ-lăr): pertaining to (the area) around the tonsils <i>peri-</i> : around <i>-ar</i> : pertaining to
pharyng/o	pharynx (throat)	<b>pharyng/o</b> /scope (făr-ĪN-gō-skōp): instrument for examining the pharynx <i>-scope</i> : instrument for examining
epiglott/o	epiglottis	<b>epiglott</b> /itis (ĕp-ĭ-glōt-Ī-tĭs): inflammation of the epiglottis <i>-itis</i> : inflammation  <i>Because the epiglottis seals the passageway traveled by air to and from the lungs, inflammation can lead to severe airway obstruction and death. Epiglottitis is treated as a medical emergency.</i>
laryng/o	larynx (voice box)	<b>laryng/o</b> /plegia (lă-rĭn-gō-PLĒ-jĕ-ă): paralysis of the (vocal cords and) larynx <i>-plegia</i> : paralysis
trache/o	trachea (windpipe)	<b>trache/o</b> /plasty (TRĀ-kĕ-ō-plăs-tĕ): surgical repair of the trachea <i>-plasty</i> : surgical repair  <i>Tracheoplasty is performed to correct a narrow or stenotic trachea.</i>

bronchi/o	bronchus (plural, bronchi)	<b>bronchi/ectasis</b> (brŏng-kē-ĔK-tă-sĭs): dilation of (one or more) bronchi -ectasis: dilation, expansion <i>Bronchiectasis is associated with various lung conditions and is commonly accompanied by chronic infection.</i>
bronch/o		<b>bronch/o/scope</b> (BRŎNG-kō-skōp): instrument for examining the bronchus or bronchi -scope: instrument for examining <i>A bronchoscope is a flexible tube that is passed through the nose or mouth and enables inspection of the lungs and collection of tissue biopsies and secretions for analysis.</i>
bronchiol/o	bronchiole	<b>bronchiol/itis</b> (brŏng-kē-ō-LĪ-tĭs): inflammation of the bronchioles -itis: inflammation
alveol/o	alveolus; air sac	<b>alveol/ar</b> (ăl-VĔ-ō-lăr): pertaining to the alveoli -ar: pertaining to
pleur/o	pleura	<b>pleur/o/centesis</b> (ploo-rō-sĕn-TĔ-sĭs): surgical puncture of the pleural cavity; also called <i>thoracocentesis</i> or <i>thoracentesis</i> -centesis: surgical puncture
pneum/o	air; lung	<b>pneum/ectomy</b> (nūm-ĔK-tō-mē): excision of (all or part of) a lung -ectomy: excision
pneumon/o		<b>pneumon/ia</b> (nū-MŌ-nē-ă): condition of inflammation of the lungs -ia: condition <i>The usual causes of pneumonia are infections due to bacteria, viruses, or other pathogenic organisms.</i>

(continued)

Element	Meaning	Word Analysis
pulmon/o	lung	<b>pulmon/o</b> /logist (pŭl-mŏ-NŎL-ŏ-jĭst): specialist in the study (and treatment) of lungs (and respiratory diseases) <i>-logist: specialist in the study of</i>
<b>Other</b>		
anthrac/o	coal, coal dust	<b>anthrac/osis</b> (ăn-thră-KŎ-sĭs): abnormal condition of coal dust (in the lungs) <i>-osis: abnormal condition; increase (used primarily with blood cells)</i> <i>Anthracosis is a chronic occupational disease found in coal miners and those associated with the coal industry.</i>
atel/o	incomplete; imperfect	<b>atel/ectasis</b> (ăt-ĕ-LĚK-tă-sĭs): incomplete expansion of the lung; also called <i>airless lung</i> or <i>collapsed lung</i> <i>-ectasis: dilation, expansion</i>
coni/o	dust	<b>pneum/o</b> / <b>coni/osis</b> (nŭ-mŏ-kŏ-nĕ-Ŏ-sĭs): condition of dust in the lungs <i>pneum/o: air; lung</i> <i>-osis: abnormal condition; increase (used primarily with blood cells)</i> <i>Pneumoconiosis is usually caused by mineral dusts of occupational or environmental origin. Forms of pneumoconiosis include silicosis, asbestosis, and anthracosis.</i>

cyan/o	blue	<p><b>cyan/osis</b> (sī-ă-NŌ-sīs): abnormal condition of blueness  <i>-osis</i>: abnormal condition; increase (used primarily with blood cells)</p> <p><i>Cold temperatures, heart failure, lung diseases, and smothering cause unusual blueness of the skin and mucous membranes due to the build-up of carbon dioxide in the blood.</i></p>
lob/o	lobe	<p><b>lob/ectomy</b> (lō-BĚK-tō-mē): excision of a lobe  <i>-ectomy</i>: excision</p> <p><i>Lobectomies are performed when a malignancy is confined to a single lobe of any lobed organ, such as the lungs, liver, brain, and thyroid gland.</i></p>
orth/o	straight	<p><b>orth/o/pnea</b> (or-THŎP-nē-ă): breathing in a straight (or upright position)  <i>-pnea</i>: breathing</p> <p><i>Various lung disorders cause a patient to experience difficulty breathing in any position other than sitting or standing erect.</i></p>
ox/i	oxygen	<p><b>ox/i/meter</b> (ŏk-SĪM-ě-tēr): instrument used for measuring oxygen  <i>-meter</i>: instrument for measuring</p> <p><i>An oximeter is usually attached to the tip of a finger but may also be placed on a toe or ear lobe. It provides a measurement of the oxygen saturation level of the blood.</i></p>
ox/o		<p><b>hyp/ox/emia</b> (hī-pŏks-Ē-mē-ă): deficiency of oxygen in blood  <i>hyp-</i>: under, below, deficient  <i>-emia</i>: blood condition</p>
pector/o	chest	<p><b>pector/algia</b> (pĕk-tō-RĂL-jē-ă): pain in the chest; also called <i>thoracalgia</i>, <i>thoracodynia</i>, and <i>pectorodynia</i>  <i>-algia</i>: pain</p>

Element	Meaning	Word Analysis
thorac/o		<b>thorac/o/pathy</b> (thō-răk-ŎP-ă-thē): disease of the chest <i>-pathy</i> : disease
phren/o	diaphragm; mind	<b>phren/o/spasm</b> (FRĚN-ō-spăzm): involuntary contraction of the diaphragm <i>-spasm</i> : involuntary contraction, twitching
spir/o	breathe	<b>spir/o/meter</b> (spī-RŎM-ět-ěr): instrument for measuring breathing <i>-meter</i> : instrument for measuring  <i>A spirometer measures how much air the lungs can hold (vital capacity) as well as how much and how quickly air can be exhaled.</i>

Suffixes		
-capnia	carbon dioxide (CO <sub>2</sub> )	hyper/ <b>capnia</b> (hī-pĕr-KĀP-nē-ă): excessive CO <sub>2</sub> <i>hyper-</i> : excessive, above normal
-osmia	smell	an/ <b>osmia</b> (ăn-ŌZ-mē-ă): without (the sense of) smell <i>an-</i> : without, not
-phonia	voice	dys/ <b>phonia</b> (dĭs-FŌ-nē-ă): bad (impaired) voice quality <i>dys-</i> : bad; painful; difficult <i>Dysphonia includes hoarseness, voice fatigue, or decreased projection.</i>
-pnea	breathing	a/ <b>pnea</b> (ăp-NĒ-ă): not breathing <i>a-</i> : without, not <i>Apnea is a temporary loss of breathing and includes sleep apnea, cardiac apnea, and apnea of the newborn.</i>
-ptysis	spitting	hem/o/ <b>ptysis</b> (hē-MŎP-tĭ-sĭs): (coughing up or) spitting of blood <i>hem/o</i> : blood <i>Bloody sputum is usually a sign of a serious condition of the lungs.</i>
-thorax	chest	py/o/ <b>thorax</b> (pī-ō-THŌ-răks): pus in the chest (cavity); also called <i>empyema</i> <i>py/o</i> : pus <i>Pyothorax is usually caused by a penetrating chest wound or spreading of infection from another part of the body.</i>

Prefixes		
brady-	slow	<b>brady/pnea</b> (brăd-ĭp-NĒ-ă): slow breathing -pnea: breathing
dys-	bad; painful; difficult	<b>dys/pnea</b> (dĭsp-NĒ-ă): difficult breathing -pnea: breathing <i>Dyspnea includes any discomfort or significant breathlessness.</i>
eu-	good, normal	<b>eu/pnea</b> (ūp-NĒ-ă): normal breathing -pnea: breathing <i>The normal range for a resting adult respiratory rate is 12 to 20 breaths/minute.</i>
tachy-	rapid	<b>tachy/pnea</b> (tăk-ĭp-NĒ-ă): rapid breathing -pnea: breathing

# Asthma

- Asthma produces spasms in the bronchial passages (**bronchospasms**) that may be sudden and violent (**paroxysmal**) and lead to dyspnea. Asthma is commonly caused by exposure to allergens or irritants. Other causes include stress, cold, and exercise. During recovery, coughing episodes produce large amounts of mucus (**productive cough**). Over time, the epithelium of the bronchial passages thickens, and breathing becomes more difficult. Treatment includes agents that loosen and break down mucus (**mucolytics**) and medications that expand the bronchi (**bronchodilators**) by relaxing their smooth muscles. If usual measures do not reverse the bronchospasms, the condition is referred to as ***status asthmaticus***.

# Chronic Bronchitis

- **Chronic bronchitis** is an inflammation of the bronchi caused mainly by smoking and air pollution. However, other agents, such as viruses and bacteria may also cause the disorder. Bronchitis is characterized by swelling of the mucosa and a heavy, productive cough, commonly accompanied by chest pain. Patients usually seek medical help when they suffer exercise intolerance, wheezing, and shortness of breath (SOB). Bronchodilators and medications that aid in the removal of mucus (**expectorants**) help to widen air passages. Steroids may be prescribed if the disease progresses or becomes chronic.

# Emphysema

- **Emphysema** is characterized by decreased elasticity of the alveoli. The alveoli expand (**dilate**) but are unable to contract to their original size. The air that remains trapped in the chest results in a characteristic “barrel-chested” appearance. This disease commonly occurs with another respiratory disorder, such as asthma, tuberculosis, or chronic bronchitis. It is also found in long-term heavy smokers. Most emphysema sufferers find it easier to breathe when sitting upright or standing erect (**orthopnea**). As the disease progresses, relief even in the orthopneic position is not possible. Treatment for emphysema is similar to that of chronic bronchitis.

# Pleural effusions

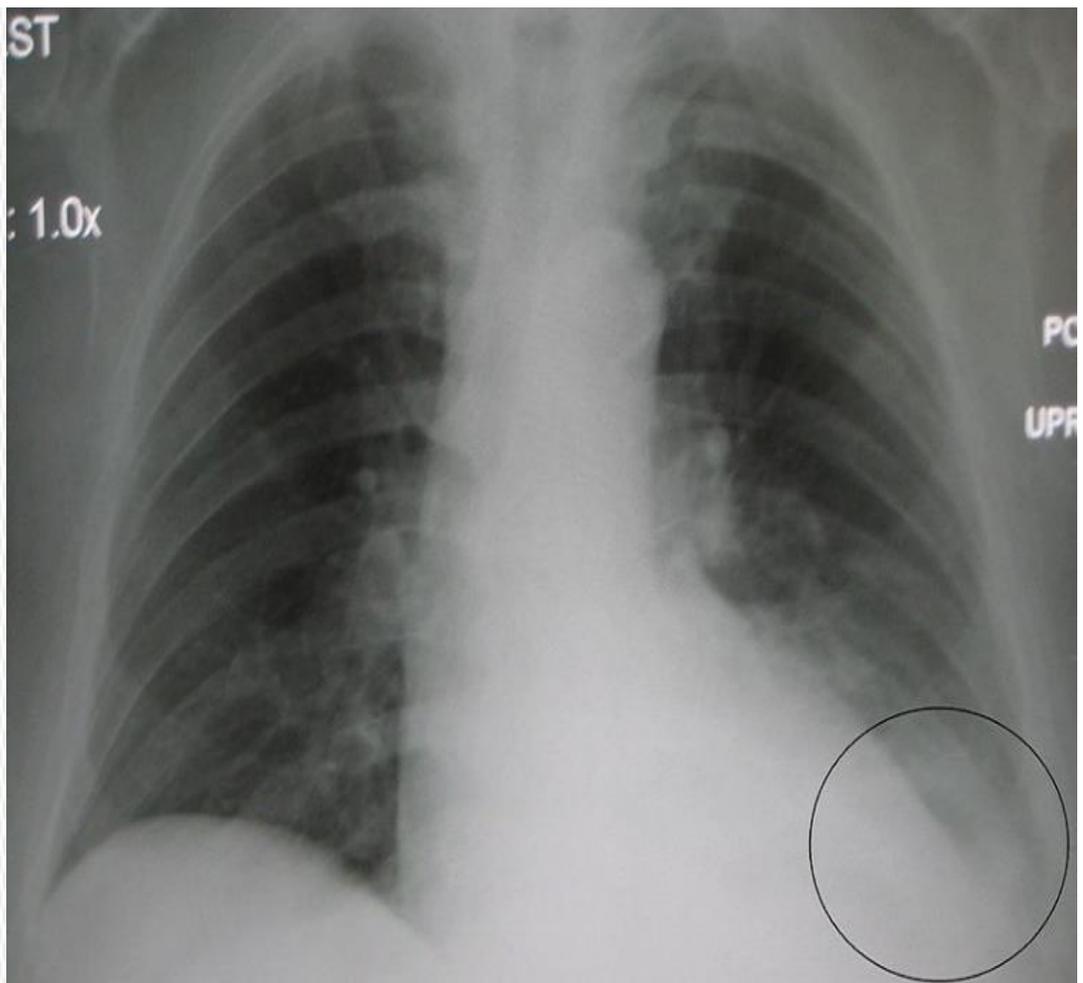
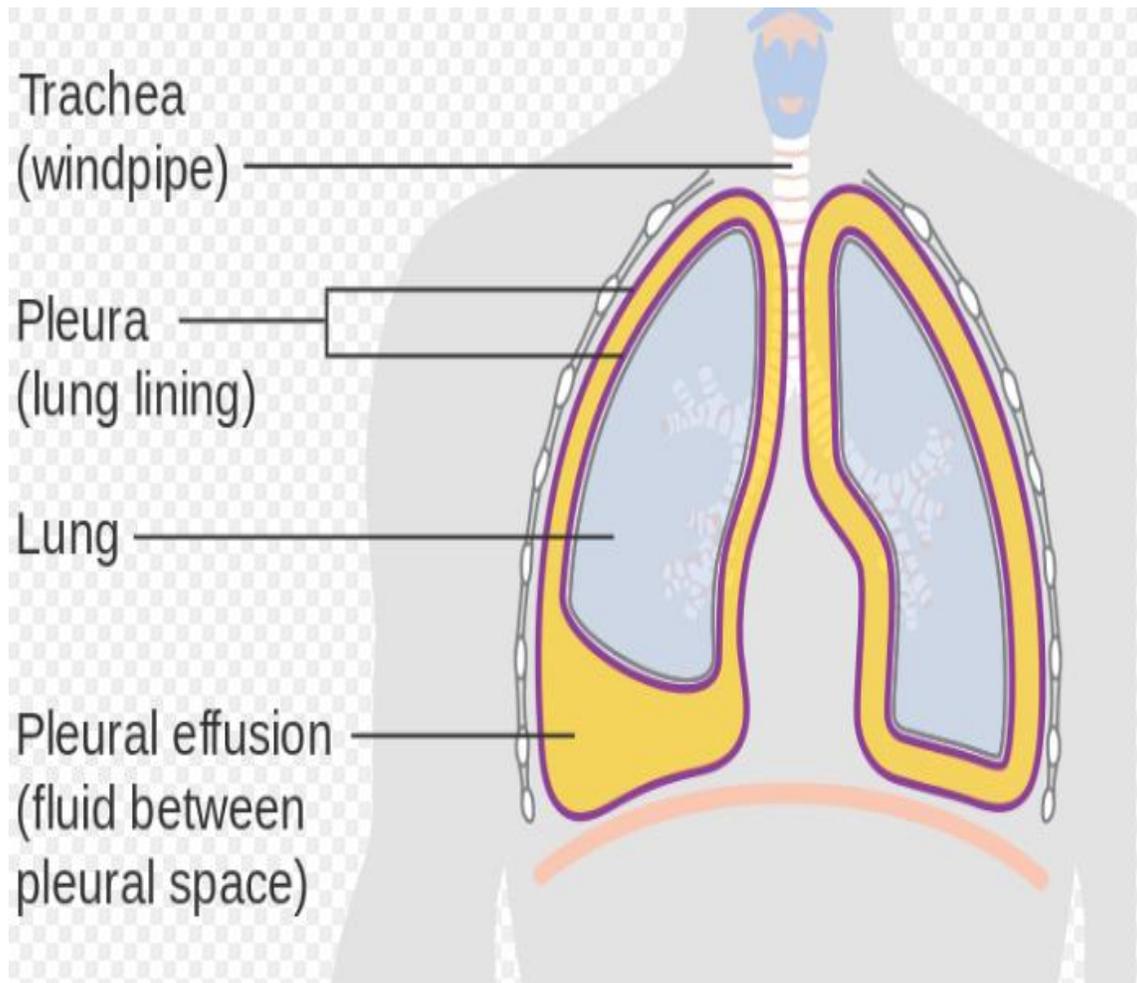
- Any abnormal fluid in the pleural cavity, the space between the visceral and parietal pleura, is called a ***pleural effusion***. Normally, the pleural cavity contains only a small amount of lubricating fluid. However, some disorders may cause excessive fluid to collect in the pleural cavity. Two initial techniques used to diagnose pleural effusion are auscultation and percussion.

# Pleural effusions

- Effusions are classified as transudates and exudates. A **transudate** is a noninflammatory fluid that resembles serum but with slightly less protein. It results from an imbalance in venousarterial pressure or decrease of protein in blood. Both of these conditions allow serum to leak from the vascular system and collect in the pleural space. Common causes include left ventricular heart failure and liver disorders. An **exudate** is usually high in protein and often contains blood and immune cells.

# Pleural effusions

- Common causes include tumors, infections, and inflammation. Various types of pleural effusions include serum (**hydrothorax**), pus (**empyema** or **pyothorax**), and blood (**hemothorax**). Although not considered a pleural effusion, air can enter the pleural space (**pneumothorax**) resulting in a partial or complete collapse of a lung.



# Tuberculosis

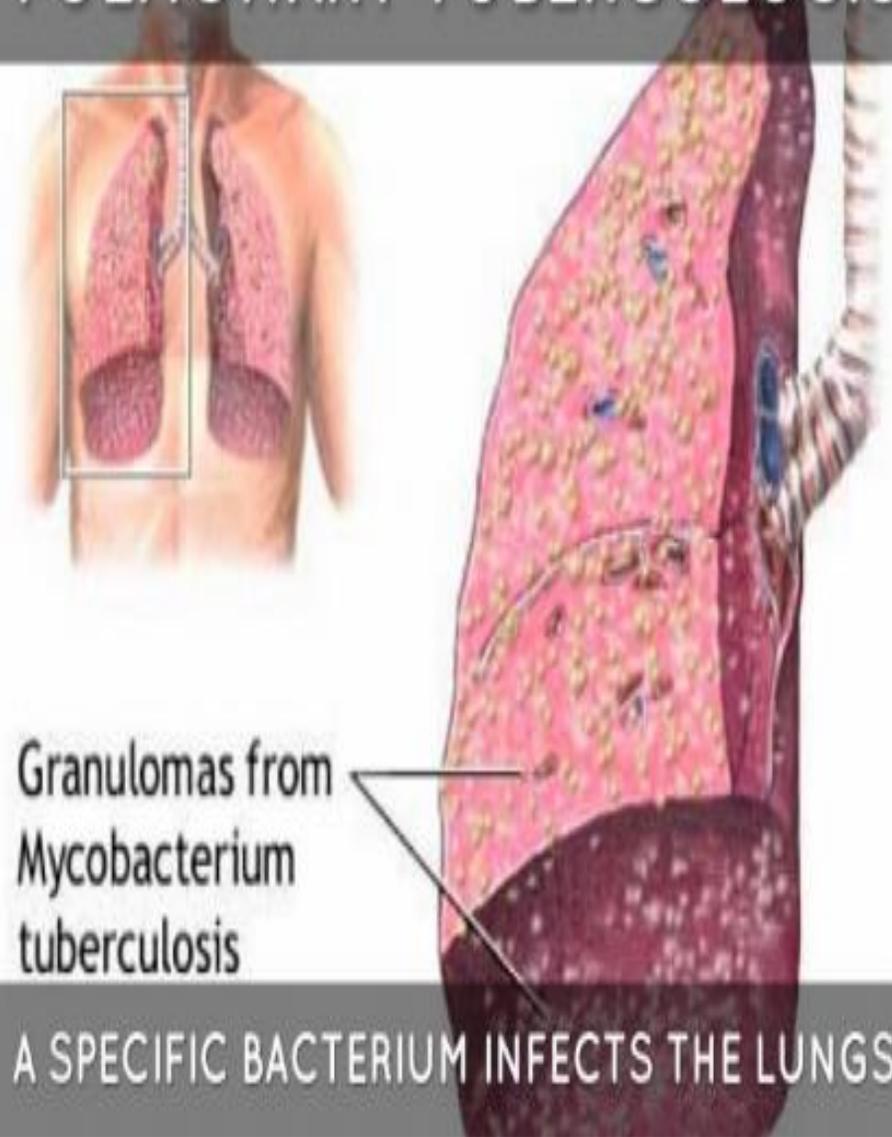
- **Tuberculosis (TB)** is a communicable disease caused by the bacterium *Mycobacterium tuberculosis*. TB spreads by droplets of respiratory secretions (**droplet nuclei**) from an infected individual when he/she coughs, laughs, or sneezes. The waxy coat of the TB organism keeps it alive (**viable**) and infectious for 6 to 8 months outside the body. It also makes laboratory staining of this organism more challenging. Hence TB is also known as the *acid-fast bacillus* (AFB), a reference to its more complex method of laboratory staining.

# Tuberculosis

- The first time the TB organism enters the body (**primary tuberculosis**), the disease develops slowly. It eventually produces typical inflammatory nodules (**granulomas**) called **tubercles**. These granulomas usually remain dormant for years, during which time the patient is asymptomatic. When the immune system becomes impaired (**immunocompromised**) or when the patient is reexposed to the bacterium, a full-blown disease may develop.



# PULMONARY TUBERCULOSIS



Granulomas from  
*Mycobacterium*  
tuberculosis

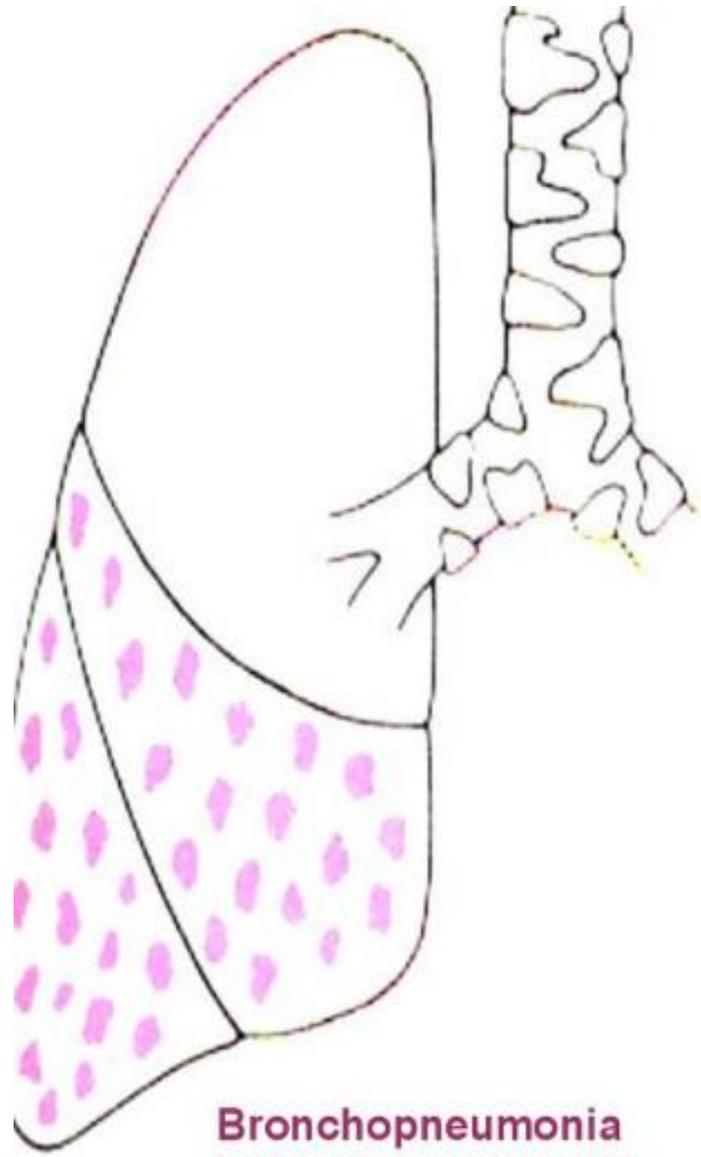
A SPECIFIC BACTERIUM INFECTS THE LUNGS.

# Pneumonia

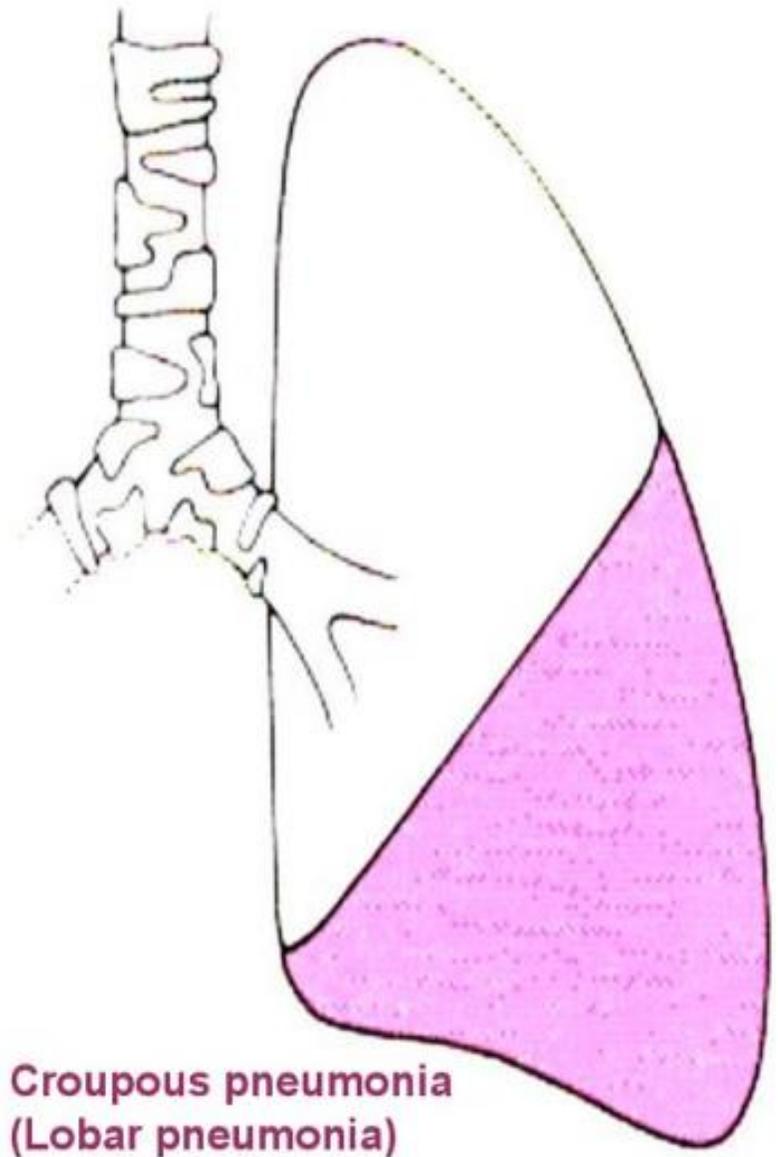
- **Pneumonia** is any inflammatory disease of the lungs that may be caused by bacteria, viruses, or fungi. Chemicals or other agents can cause the lungs to become inflamed. A type of pneumonia associated with influenza is sometimes fatal. Other potentially fatal pneumonias may result from food or liquid inhalation (**aspiration pneumonias**).

# Pneumonia

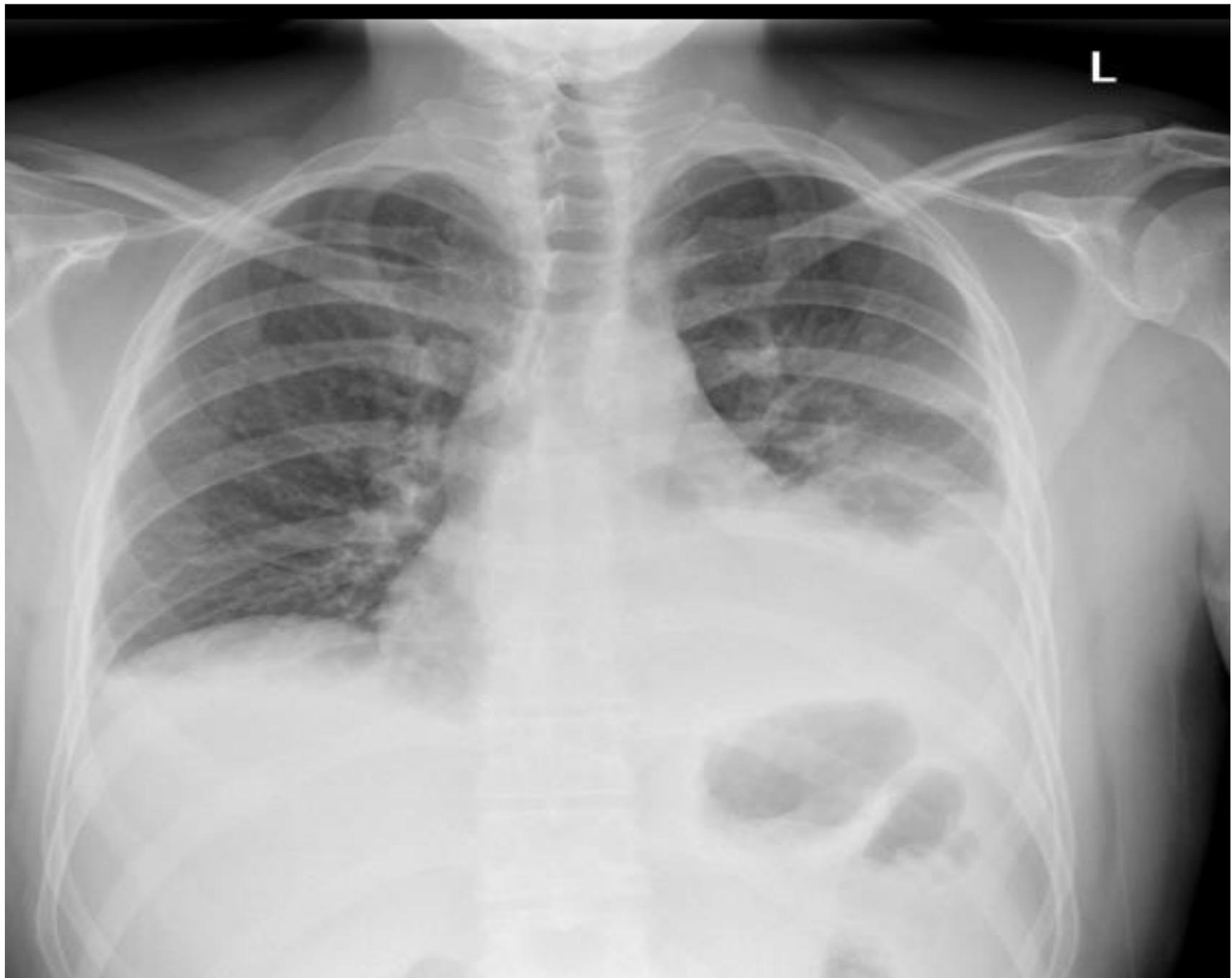
- Some pneumonias affect only a lobe of the lung (**lobar pneumonia**), but some are more diffuse (**bronchopneumonia**). Chest pain, mucopurulent sputum, and spitting of blood (**hemoptysis**) are common signs and symptoms of the disease. If the air in the lungs is replaced by fluid and inflammatory debris, the lung tissue loses its spongy texture and becomes swollen and engorged (**consolidation**). Consolidation is associated primarily with bacterial pneumonias, not viral pneumonias.



**Bronchopneumonia**  
(a focal pneumonia))



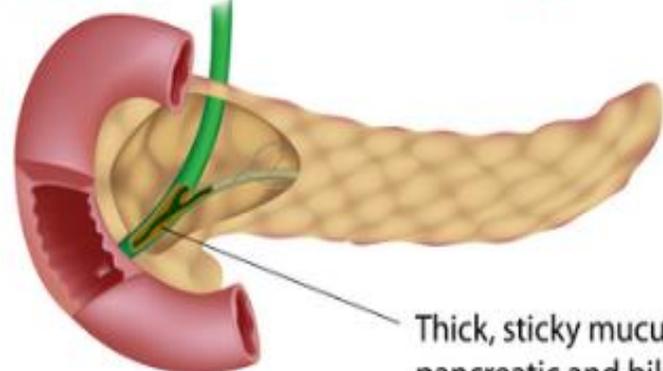
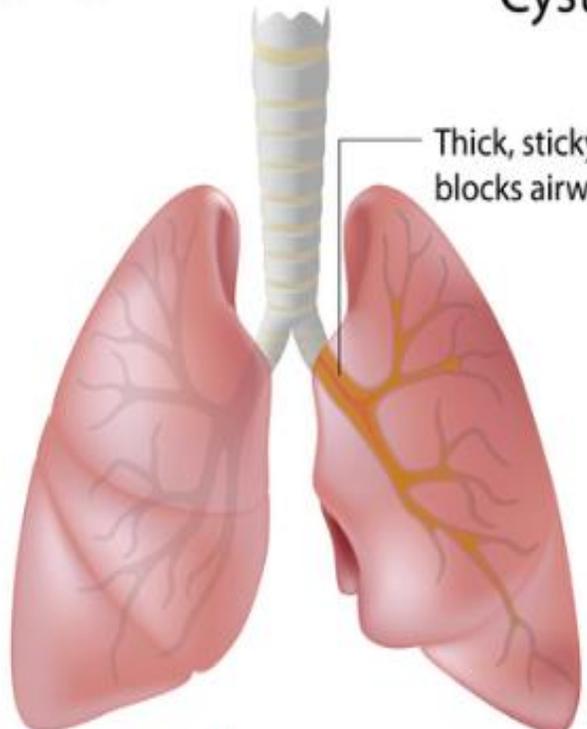
**Croupous pneumonia**  
(Lobar pneumonia)



# Cystic Fibrosis

- **Cystic fibrosis** is a hereditary disorder of the exocrine glands that causes the body to secrete extremely thick (**viscous**) mucus. This thickened mucus clogs ducts of the pancreas and digestive tract. As a result, digestion is impaired and the patient may suffer from malnutrition. It also blocks ducts of the sweat glands, causing the skin to become highly “salty.” In the lungs, mucus blocks airways and impedes natural disease-fighting mechanisms, causing repeated infections. Medication in the form of mists (**aerosols**) along with postural drainage provide relief.
- An important diagnostic test called the **sweat test** measures the amount of salt excreted in sweat. When elevated, it indicates cystic fibrosis.

# Cystic Fibrosis



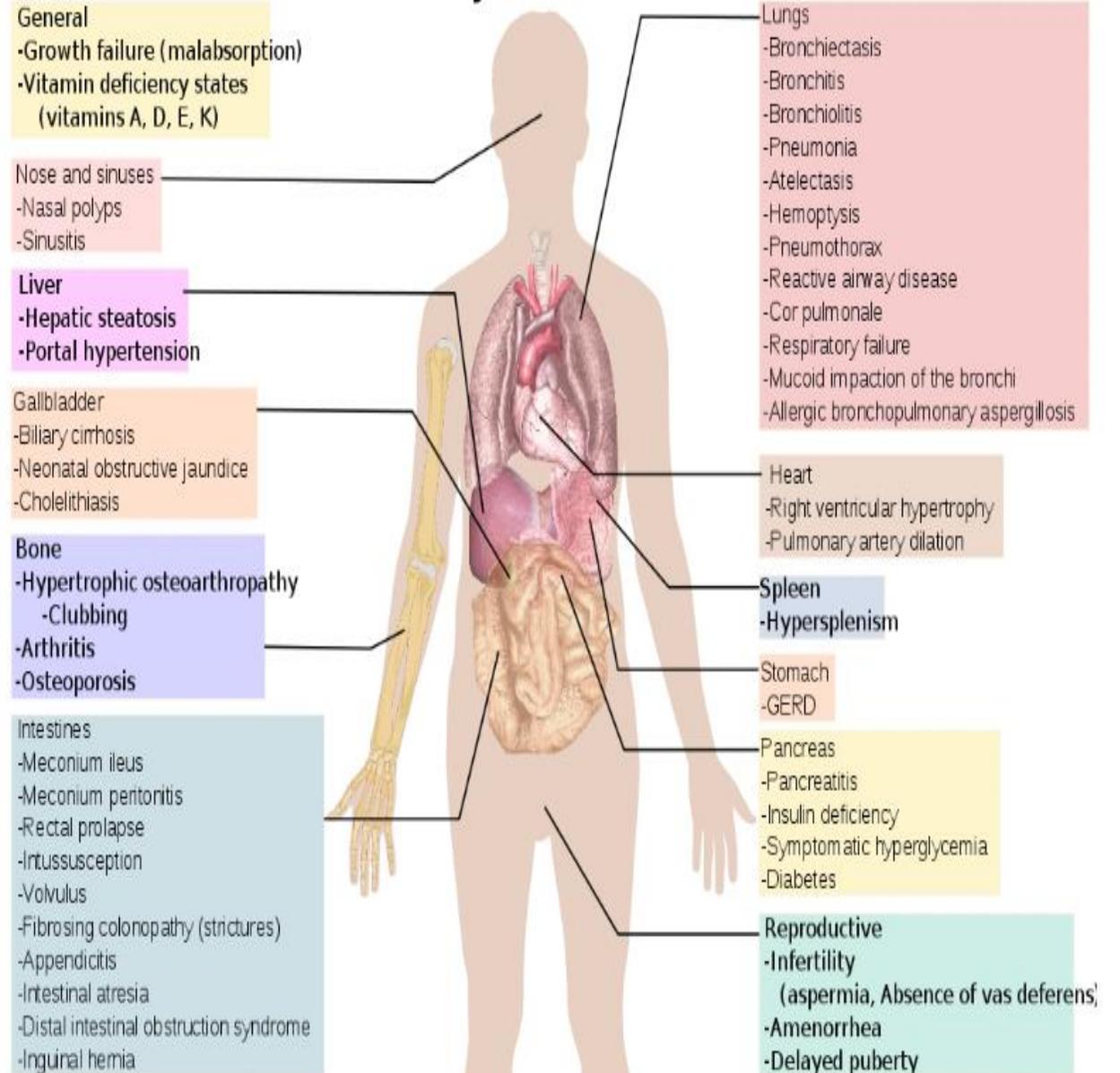
CFTR gene



Chromosome 7

600 x 600

# Manifestations of Cystic Fibrosis



# Diagnostic, Symptomatic, and Related Terms

*This section introduces diagnostic, symptomatic, and related terms and their meanings. Word analyses for selected terms are also provided.*

Term	Definition
acidosis ă-s-ĭ-DŌ-sĭs	Excessive acidity of body fluids <i>Respiratory acidosis is commonly associated with pulmonary insufficiency and the subsequent retention of carbon dioxide</i>
anosmia ă-n-ŌZ-mē-ă <i>an-</i> : without, not <i>-osmia</i> : smell	Absence of the sense of smell <i>Anosmia usually occurs as a temporary condition resulting from an upper respiratory infection or a condition that causes intranasal swelling.</i>

apnea

ăp-NĒ-ă

*a-*: without, not

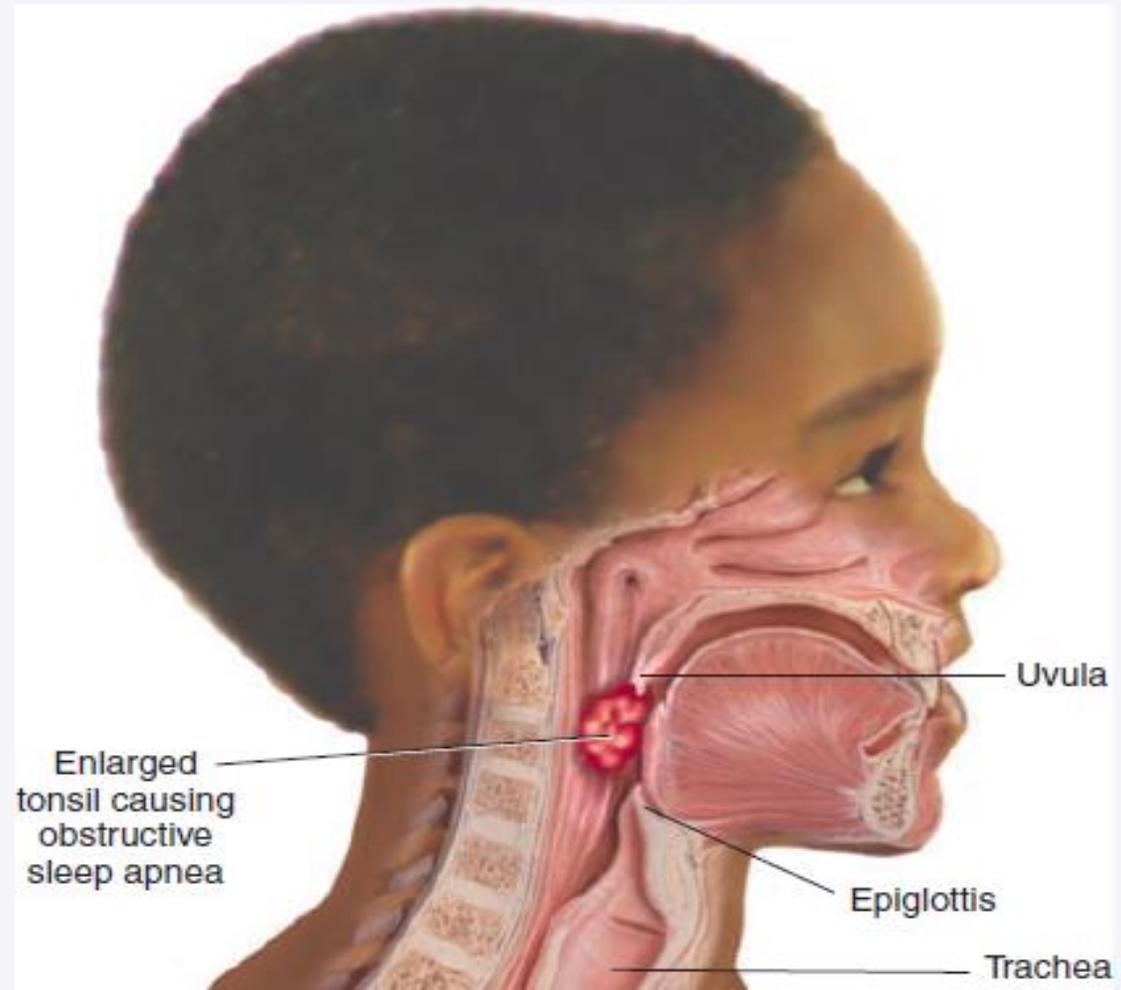
*-pnea*: breathing

sleep

Temporary loss of breathing

*There are three types of apnea: obstructive (enlarged tonsils and adenoids), central (failure of the brain to transmit impulses for breathing), and mixed (combination of obstructive and central apnea).*

Sleeping disorder in which breathing stops repeatedly for more than 10 seconds, causing measurable blood deoxygenation. (See Figure 7-6.)





B.

**Figure 7-6.** Sleep apnea. (A) Airway obstruction caused by enlarged tonsils, eventually leads to obstructive sleep apnea. (B) Continuous positive airway pressure (CPAP) machine used to treat sleep apnea.

*(continued)*

## Diagnostic, Symptomatic, and Related Terms—cont'd

### Term

### Definition

asphyxia

ās-FĪK-sē-ă

*a-*: without, not  
*-sphyxia*: pulse

Condition caused by insufficient intake of oxygen

*Some common causes of asphyxia are drowning, electric shock, lodging of a foreign body in the respiratory tract, inhalation of toxic smoke, and poisoning.*

atelectasis

ăt-ĕ-LĒK-tă-sĭs

*atel*: incomplete; imperfect  
*-ectasis*: dilation, expansion

Collapsed or airless state of the lung, which may be acute or chronic and affect all or part of a lung

*Atelectasis is a potential complication of some surgical procedures, especially those of the chest because breathing is commonly shallow after surgery to avoid pain from the surgical incision. In fetal atelectasis, the lungs fail to expand normally at birth.*

cheyne-Stokes respiration

chān-stōks

Repeated breathing pattern characterized by fluctuation in the depth of respiration, first deeply, then shallow, then not at all

*Cheyne-Stokes respirations are usually caused by diseases that affect the respiratory centers of the brain (such as heart failure and brain damage).*

<p>compliance kõm-PLĪ-āns</p>	<p>Ease with which lung tissue can be stretched <i>Low compliance means lungs are less elastic; therefore, more effort is required to inflate the lungs.</i></p>
<p>coryza kõ-RĪ-zā</p>	<p>Head cold; upper respiratory infection (URI)</p>
<p>crackle KRĀK-ěl</p>	<p>Abnormal respiratory sound heard on auscultation, caused by exudates, spasms, hyperplasia, or when air enters moisture-filled alveoli; also called <i>rale</i></p>
<p>croup croop</p>	<p>Common childhood condition involving inflammation of the larynx, trachea, bronchial passages and, sometimes, lungs <i>Signs and symptoms include a resonant, barking cough with suffocative, difficult breathing; laryngeal spasms, and, sometimes, the narrowing of the top of the air passages.</i></p>
<p>deviated nasal septum DĒ-vē-āt-ěd NĀ-zl SĚP-tům</p>	<p>Displacement of cartilage dividing the nostrils</p>
<p>epiglottitis ěp-ĭ-glõt-Ī-tĭs <i>epiglott:</i> epiglottis <i>-itis:</i> inflammation</p>	<p>Severe, life-threatening infection of the epiglottis and supraglottic structures that occurs most commonly in children between 2 and 12 years of age <i>Signs and symptoms of epiglottitis include fever, dysphagia, inspiratory stridor, and severe respiratory distress. Intubation or tracheostomy may be required to open the obstructed airway.</i></p>

epistaxis

ĕp-ĭ-STĀK-sĭs

Nosebleed; nasal hemorrhage

finger clubbing

KLŮB-ing

Enlargement of the terminal phalanges of the fingers and toes, commonly associated with pulmonary disease

hypoxemia

hĭ-pŏks-Ē-mĕ-ă

*hyp-*: under, below, deficient

*ox*: oxygen

*-emia*: blood condition

Deficiency of oxygen in the blood

*Hypoxemia is usually a sign of respiratory impairment.*

## Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
<p>hypoxia hī-PŎKS-ē-ă <i>hyp-</i>: under, below, deficient <i>-oxia</i>: oxygen</p>	<p>Deficiency of oxygen in tissues <i>Hypoxia is usually a sign of respiratory impairment.</i></p>
<p>pertussis pěr-TŪS-ĭs</p>	<p>Acute infectious disease characterized by a cough that has a “whoop” sound; also called <i>whooping</i> cough <i>Immunization of infants as part of the diphtheria-pertussis-tetanus (DPT) vaccination is effective in the prevention of pertussis.</i></p>
<p>pleurisy PLOO-rĭs-ē <i>pleur</i>: pleura <i>-isy</i>: state of; condition</p>	<p>Inflammation of the pleural membrane characterized by a stabbing pain that is intensified by coughing or deep breathing; also called <i>pleuritis</i></p>
<p>pneumoconiosis nū-mō-kō-nē-Ō-sĭs <i>pneum/o</i>: air; lung <i>coni</i>: dust <i>-osis</i>: abnormal condition; increase (used primarily with blood cells)</p>	<p>Disease caused by inhaling dust particles, including coal dust (anthracosis), stone dust (chalicosis), iron dust (siderosis), and asbestos particles (asbestosis)</p>

pulmonary edema  
PŪL-mō-ně-rē ě-DĚ-mă  
*pulmon*: lung  
*-ary*: pertaining to

Accumulation of extravascular fluid in lung tissues and alveoli, caused most commonly by heart failure  
*Excessive fluid in the lungs induces coughing and dyspnea.*

pulmonary embolus  
PŪL-mō-ně-rē ĚM-bō-lŭs  
*pulmon*: lung  
*-ary*: pertaining to  
*embol*: plug  
*-us*: condition, structure

Blockage in an artery of the lungs caused by a mass of undissolved matter (such as a blood clot, tissue, air bubbles, and bacteria)

rhonchus  
RÖNG-kŭs

Abnormal breath sound heard on auscultation  
*A rhonchus is described as a course, rattling noise that resembles snoring, commonly suggesting secretions in the larger airways.*

stridor  
STRĪ-dor

High-pitched, harsh, adventitious breath sound caused by a spasm or swelling of the larynx or an obstruction in the upper airway  
*The presence of stridor requires immediate intervention.*

sudden infant death syndrome  
(SIDS)

Completely unexpected and unexplained death of an apparently normal, healthy infant, usually less than 12 months of age; also called *crib death*  
*The rate of SIDS has decreased more than 30% since parents have been instructed to place babies on their backs for sleeping rather than on their stomachs.*

wheeze  
HWĚZ

Whistling or sighing sound heard on auscultation that results from narrowing of the lumen of the respiratory passageway

Procedure	Description
<i>Diagnostic Procedures</i>	
<b>Clinical</b>	
<p>Mantoux test măn-TŪ</p>	<p>Intradermal test to determine tuberculin sensitivity based on a positive reaction where the area around the test site becomes red and swollen</p> <p><i>A positive test suggests a past or present exposure to TB or past TB vaccination. However, the Mantoux test does not differentiate between active and inactive infection.</i></p>
<p>oximetry ōk-SĪM-ě-trē <i>ox/i:</i> oxygen <i>-metry:</i> act of measuring</p>	<p>Noninvasive method of monitoring the percentage of hemoglobin (Hb) saturated with oxygen; also called pulse oximetry</p> <p><i>In oximetry, a probe is attached to the patient's finger or ear lobe and linked to a computer that displays the percentage of hemoglobin saturated with oxygen.</i></p>
<p>polysomnography pōl-ē-sōm-NŌG-ră-fē <i>poly-:</i> many, much <i>somn/o:</i> sleep <i>-graphy:</i> process of recording</p>	<p>Test of sleep cycles and stages using continuous recordings of brain waves (EEGs), electrical activity of muscles, eye movement (electro-oculogram), respiratory rate, blood pressure, blood oxygen saturation, heart rhythm and, sometimes, direct observation of the person during sleep using a video camera</p>
<p>pulmonary function tests (PFTs) PŪL-mō-ně-rē <i>pulmon:</i> lung <i>-ary:</i> pertaining to</p>	<p>Multiple tests used to evaluate the ability of the lungs to take in and expel air as well as perform gas exchange across the alveolocapillary membrane</p>

## spirometry

spī-RŌM-ě-trē

*spir/o*: breathe

*-metry*: act of measuring

Measurement of ventilatory ability by assessing lung capacity and flow, including the time necessary for exhaling the total volume of inhaled air

*A spirometer produces a graphic record for placement in the patient's chart.*

## Endoscopic

### bronchoscopy

brŏng-KŌS-kō-pē

*bronch/o*: bronchus

*-scopy*: visual examination

Visual examination of the bronchi using an endoscope (flexible fiberoptic or rigid) inserted through the mouth and trachea for direct viewing of structures or for projection on a monitor (See Figure 7-7.)

*Attachments on the bronchoscope can be used to suction mucus, remove foreign bodies, collect sputum, or perform biopsy.*

### laryngoscopy

lăr-ĭn-GŌS-kō-pē

*laryng/o*: larynx (voice box)

*-scopy*: visual examination

Visual examination of the larynx to detect tumors, foreign bodies, nerve or structural injury, or other abnormalities

### mediastinoscopy

mē-dē-ās-tĭ-NŌS-kō-pē

*mediastin/o*: mediastinum

*-scopy*: visual examination

Visual examination of the mediastinal structures including the heart, trachea, esophagus, bronchus, thymus, and lymph nodes

*The mediastinoscope is inserted through a small incision made above the sternum. The attached camera projects images on a monitor. Additional incisions may be made if nodes are removed or other diagnostic or therapeutic procedures are performed.*

## Diagnostic and Therapeutic Procedures—cont'd

### Procedure

### Description

#### Laboratory

arterial blood gas (ABG)

ăr-TĒ-rē-ăl

Test that measures partial pressure of oxygen ( $P_{O_2}$ ), carbon dioxide ( $P_{CO_2}$ ), pH (acidity or alkalinity), and bicarbonate level of an arterial blood sample

*ABG analysis evaluates pulmonary gas exchange and helps guide treatment of acid-base imbalances.*

sputum culture

SPŪ-tŭm

Microbial test used to identify disease-causing organisms of the lower respiratory tract, especially those that cause pneumonias

sweat test

Measurement of the amount of salt (sodium chloride) in sweat

*A sweat test is used almost exclusively in children to confirm cystic fibrosis.*

throat culture

Test used to identify pathogens, especially group A streptococci

*Untreated streptococcal infections may lead to serious secondary complications, including kidney and heart disease.*

## Diagnostic and Therapeutic Procedures—cont'd

### Procedure

### Description

lavage  
lă-VĂZH

Irrigating or washing out of an organ, stomach, bladder, bowel, or body cavity with a stream of water or other fluid

*Lavage of the paranasal sinuses is usually performed to remove mucopurulent material in an immunosuppressed patient or one with known sinusitis that has failed medical management.*

antral  
ĂN-trăl

Irrigation of the antrum (maxillary sinus) in chronic or nonresponsive sinusitis

postural drainage  
PÖS-tū-răl

Positioning a patient so that gravity aids in the drainage of secretions from the bronchi and lobes of the lungs

### Surgical

pleurectomy  
ploor-ĔK-tō-mē  
*pleur:* pleura  
*-ectomy:* excision, removal

Excision of part of the pleura, usually parietal

*Pleurectomy is performed to reduce pain caused by a tumor mass or to prevent the recurrence of pleural effusion but is generally ineffective in the treatment of malignancy of the pleura.*

pneumectomy  
nūm-ĔK-tō-mē  
*pneum:* air; lung  
*-ectomy:* excision, removal

Excision of a lung

*The removal of a lobe of the lung is called a lobectomy*

rhinoplasty

RĪ-nō-plās-tē

*rhin/o*: nose

*-plasty*: surgical repair

Reconstructive surgery of the nose to correct deformities or for cosmetic purposes

septoplasty

sĕp-tō-PLĀS-tē

*sept/o*: septum

*-plasty*: surgical repair

Surgical repair of a deviated nasal septum usually performed when the septum is encroaching on the breathing passages or nasal structures

*Common complications of a deviated septum include interference with breathing and a predisposition to sinus infections.*

thoracentesis

thō-ră-sĕn-TĒ-sĭs

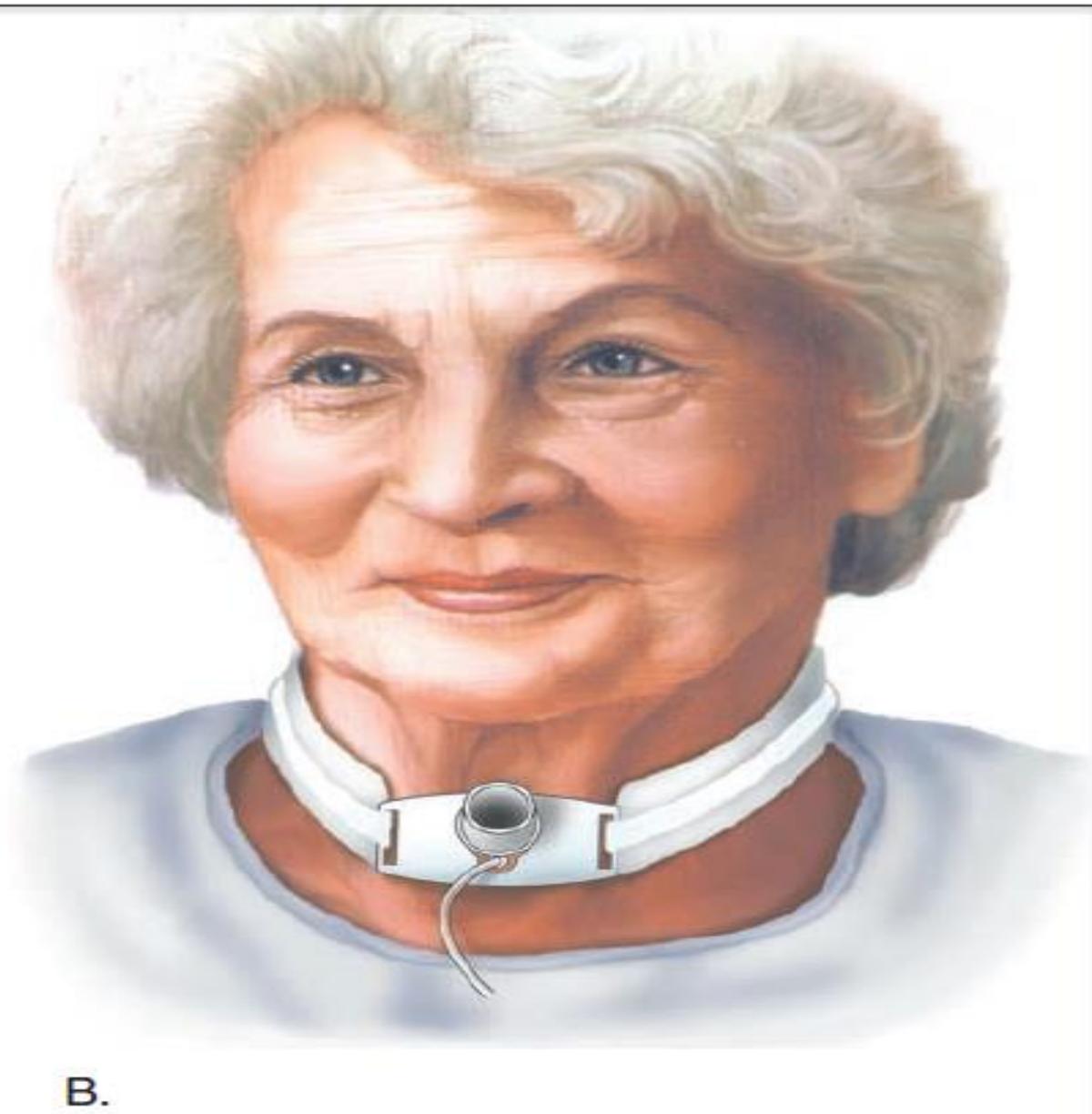
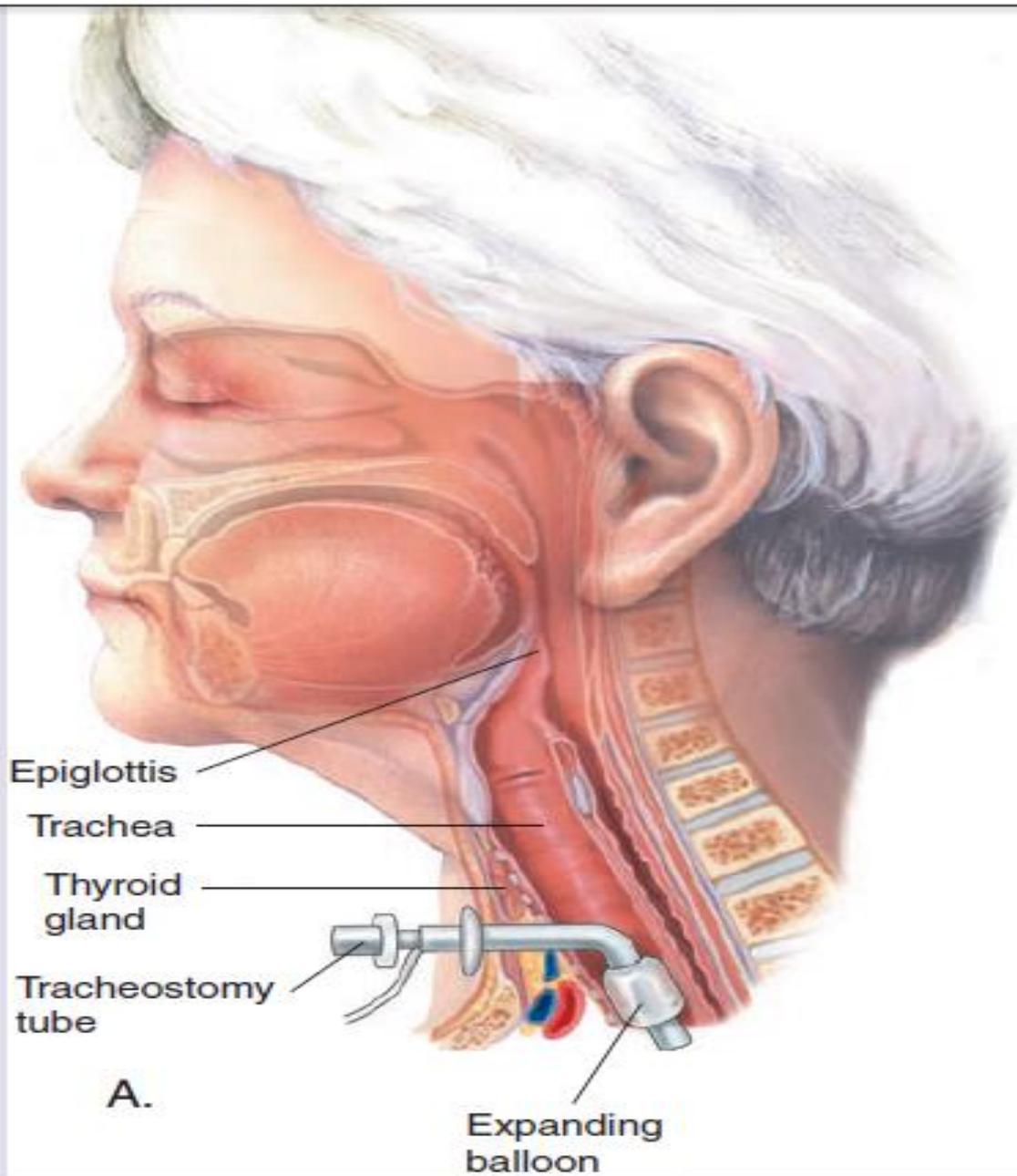
Surgical puncture and drainage of the pleural cavity; also called *pleurocentesis* or *thoracocentesis*

*Thoracentesis is performed as a diagnostic procedure to determine the nature and cause of an effusion or as a therapeutic procedure to relieve the discomfort caused by the effusion. (See Figure 7–5.)*

tracheostomy

trā-kē-ŌS-tō-mē

Surgical procedure in which an opening is made in the neck and into the trachea into which a breathing tube may be inserted (See Figure 7–10.)



**Figure 7-10.** Tracheostomy. (A) Lateral view with tracheostomy tube in place. (B) Frontal view.

## Drugs Used to Treat Respiratory Disorders

*This table lists common drug classifications used to treat respiratory disorders, their therapeutic actions, and selected generic and trade names.*

<b>Classification</b>	<b>Therapeutic Action</b>	<b>Generic and Trade Names</b>
<b>antihistamines</b>	Block histamines from binding with histamine receptor sites in tissues <i>Histamines cause sneezing, runny nose, itchiness, and rashes.</i>	<b>fexofenadine</b> fěks-ō-FĚN-ă-dĕn Allegra <b>loratadine</b> lor-ĂH-tă-dĕn Claritin
<b>antitussives</b>	Relieve or suppress coughing by blocking the cough reflex in the medulla of the brain <i>Antitussives alleviate nonproductive dry coughs and should not be used with productive coughs.</i>	<b>hydrocodone</b> hī-drō-KŌ-dŏn Hycodan <b>dextromethorphan</b> děk-strō-MĚTH-or-făn Vicks Formula 44
<b>bronchodilators</b>	Stimulate bronchial muscles to relax, thereby expanding air passages, resulting in increased air flow <i>Bronchodilators are used to treat chronic symptoms and prevent acute attacks in respiratory diseases, such as asthma and COPD. Pharmacological agents may be delivered by an inhaler either orally or intravenously.</i>	<b>albuterol</b> ăl-BŪ-těr-ăl Proventil, Ventolin <b>salmeterol</b> săl-mĕ-TĚR-ŏl Serevent

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**corticosteroids**

Act on the immune system by blocking production of substances that trigger allergic and inflammatory actions

*Corticosteroids are available as nasal sprays, in metered-dose-inhalers (inhaled steroids) and in oral forms (pills or syrups) to treat chronic lung conditions such as asthma and COPD.*

**beclomethasone dipropionate**

bě-klō-MĚTH-ă-sōn

dī-PRŌ-pě-ō-năt

Vanceril, Beclovent

**triamcinolone**

trī-ăm-SĪN-ō-lōn

Azmacort

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**decongestants**

Constrict blood vessels of nasal passages and limit blood flow, which causes swollen tissues to shrink so that air can pass more freely through the passageways

*Decongestants are commonly prescribed for allergies and colds and are usually combined with antihistamines in cold remedies. They can be administered orally or topically as nasal sprays and nasal drops.*

**oxymetazoline**

öks-ē-mět-ĂZ-ō-lēn

Dristan

**pseudoephedrine**

soo-dō-ě-FĚD-rĭn

Drixoral, Sudafed

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**expectorants**

Liquify respiratory secretions so that they are more easily dislodged during coughing episodes

*Expectorants are prescribed for productive coughs.*

**guaifenesin**

gwī-FĚN-ě-sĭn

Robitussin, Organidin

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# Abbreviations

*This section introduces respiratory-related abbreviations and their meanings.*

Abbreviation	Meaning	Abbreviation	Meaning
ABG	arterial blood gas(es)	MRI	magnetic resonance imaging
AFB	acid-fast bacillus (TB organism)	NMT	nebulized mist treatment
AP	anteroposterior	O <sub>2</sub>	oxygen
ARDS	acute respiratory distress syndrome	PA	posteroanterior; pernicious anemia
CO <sub>2</sub>	carbon dioxide	PCO <sub>2</sub>	partial pressure of carbon dioxide
COPD	chronic obstructive pul- monary disease	PCP	<i>Pneumocystis carinii</i> pneumonia; primary care physician; phencyclidine (hallucinogen)
CPAP	continuous positive airway pressure	PFT	pulmonary function test
CPR	cardiopulmonary resuscitation	pH	symbol for degree of acidity or alkalinity
CT	computed tomography	PND	paroxysmal nocturnal dyspnea
CXR	chest x-ray, chest radiograph	PO <sub>2</sub>	partial pressure of oxygen

<b>DPI</b>	dry power inhaler	<b>RD</b>	respiratory distress
<b>DPT</b>	diphtheria, pertussis, tetanus	<b>RDS</b>	respiratory distress syndrome
<b>EEG</b>	encephalogram, encephalography	<b>SaO<sub>2</sub></b>	arterial oxygen saturation
<b>FVC</b>	forced vital capacity	<b>SIDS</b>	sudden infant death syndrome
<b>Hb, Hgb</b>	hemoglobin	<b>SOB</b>	shortness of breath
<b>HMD</b>	hyaline membrane disease	<b>T&amp;A</b>	tonsillectomy and adenoidectomy
<b>Hx</b>	history	<b>TB</b>	tuberculosis
<b>IPPB</b>	intermittent positive-pressure breathing	<b>TPR</b>	temperature, pulse, and respiration
<b>IRDS</b>	infant respiratory distress syndrome	<b>URI</b>	upper respiratory infection
<b>MDI</b>	metered dose inhaler	<b>VC</b>	vital capacity

**Thank you**