

# Respiratory System



# Introduction

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## ❖ **Functions of the Respiratory System:**

- Inhale fresh air into lungs
- Exchange oxygen for carbon dioxide
- Exhale stale air

## ❖ **Organs of the Respiratory System:**

- Nasal cavity, Pharynx, Larynx, Trachea, Bronchial tubes & Lungs

## ❖ Cells of body require constant gas exchange, delivery of oxygen & removal of carbon dioxide

## ❖ Respiratory system works in conjunction with cardiovascular system to meet this need

## ❖ Respiration must be continuous to meet cells' needs

## ❖ **Respiration is subdivided into three distinct parts**

- Ventilation, Inhalation & Exhalation



# Introduction

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## ❖ **Ventilation:**

- Flow of air between outside environment and lungs

## ❖ **Inhalation:**

- Flow of air into lungs & brings fresh oxygen into air sacs

## ❖ **Exhalation:**

- Flow of air out of lungs & removes carbon dioxide from body

## ❖ **External respiration:**

- Exchange of oxygen and carbon dioxide in lungs
- Gases diffuse in opposite directions
- Oxygen Leaves air sacs and enters blood stream
- Carbon dioxide Leaves blood stream and enters air sacs

## ❖ **Internal respiration:**

- Oxygen and carbon dioxide exchange at cellular level
- Oxygen Leaves bloodstream and is delivered to tissue and used immediately for metabolism
- Carbon dioxide Waste product of metabolism, leaves tissue and enters bloodstream



# Organs of Respiratory System

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## Nasal cavity

- ❖ It is divided by nasal septum and air enters through nares
- ❖ Palate in roof of mouth separates nasal cavity above from mouth below
- ❖ Cilia
  - Small hairs line opening to nasal cavity & filter out large dirt particles before they can enter lungs
- ❖ Walls of nasal cavity and nasal septum
  - Made of flexible cartilage and covered with mucous membrane
- ❖ Much of respiratory tract is covered with mucous membrane
  - Mucus is thick and sticky secretion of membrane & cleanses air by trapping dust and bacteria
- ❖ Capillaries in mucous membranes: Warm air & humidify air

## Paranasal sinuses

- ❖ Located within facial bones
- ❖ Echo chamber for sound production
- ❖ Gives resonance to voice



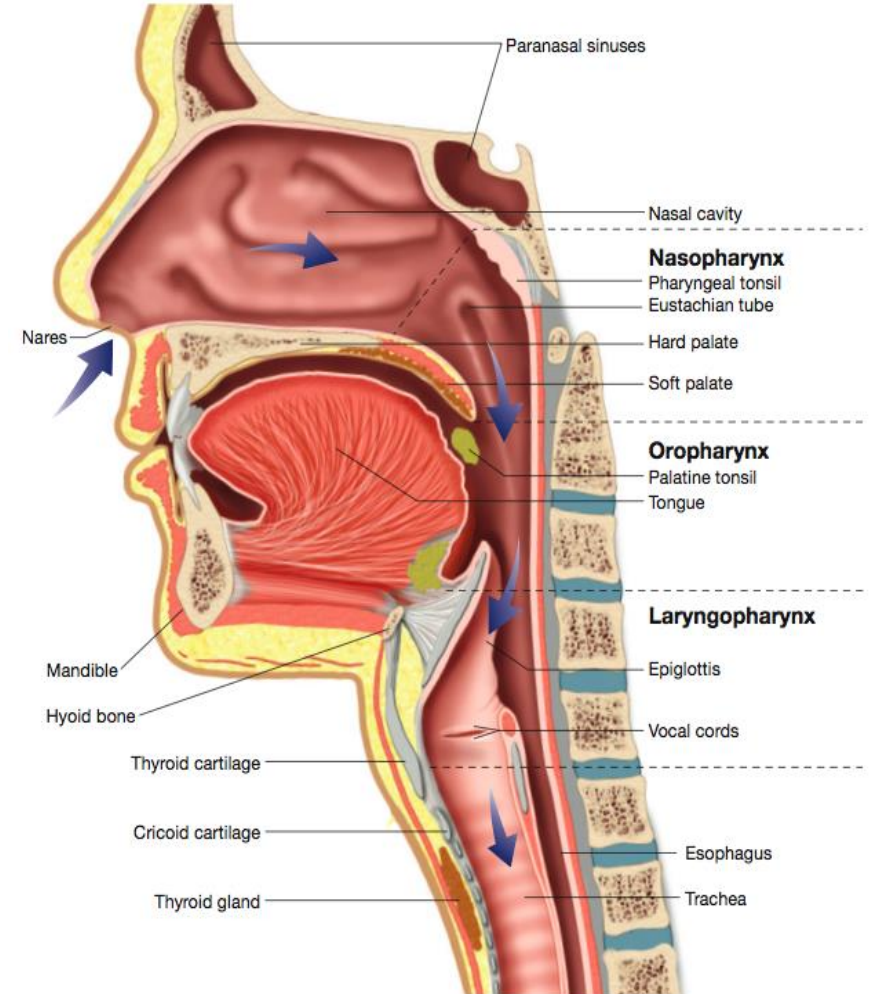
# Organs of Respiratory System

## Pharynx

- ❖ Commonly called **throat**
- ❖ Used by respiratory and digestive systems
- ❖ At end of pharynx
  - Air enters trachea
  - Food and liquids enter esophagus
- ❖ **Divisions of pharynx**
  - **Nasopharynx**: Upper section by nasal cavity
  - **Oropharynx**: Middle section by oral cavity
  - **Laryngopharynx**: Lower section by larynx

## Tonsils

- ❖ Lymphatic tissue
- ❖ Removes pathogens in air and food
- ❖ Three pairs (adenoids, palatine and lingual)



# Organs of Respiratory System

## Eustachian or Auditory Tube

- ❖ Opening found in nasopharynx
- ❖ Other end opens into middle ear
- ❖ Tube opens with each swallow
- ❖ Equalizes air pressure between middle ear and outside atmosphere

## Larynx

- ❖ Commonly called voice box
- ❖ Muscular tube between pharynx and trachea
- ❖ Contains vocal cords
- ❖ **Walls of larynx**
  - Composed of cartilage plates
  - Held in place by ligaments and muscles
  - Thyroid cartilage forms the Adam's apple





# Organs of Respiratory System

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## Vocal cords

- ❖ Folds of membranous tissue
- ❖ Not actually cord-like in structure
- ❖ Vibrate to produce sound as air passes through opening between folds Called **glottis**

## Epiglottis

- ❖ Flap of cartilage
- ❖ Sits above glottis
- ❖ Covers larynx and trachea during swallowing to allow food goes into esophagus and not into trachea



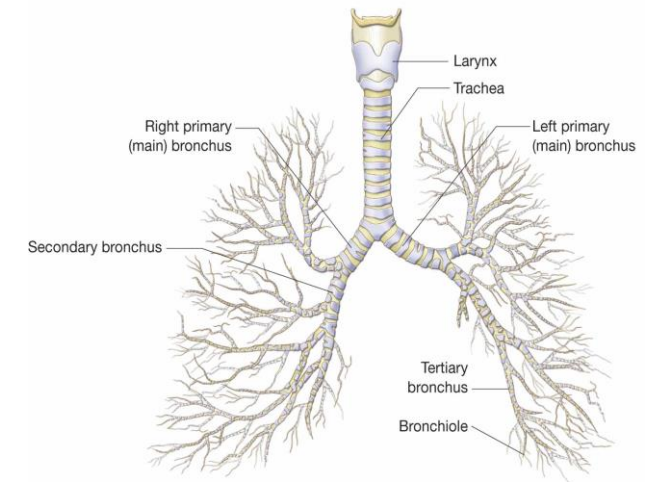
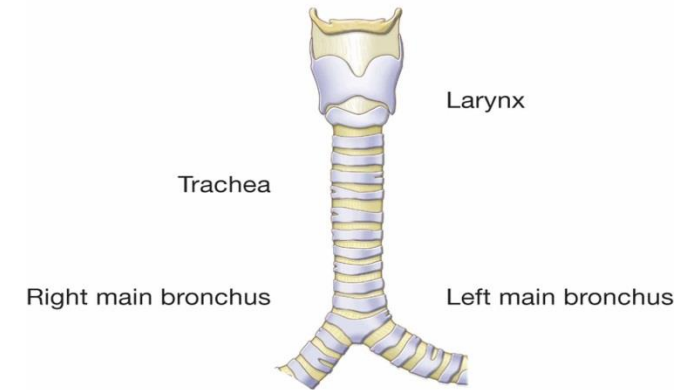
# Organs of Respiratory System

## Trachea

- ❖ Commonly called windpipe
- ❖ Carries air from larynx to main bronchi
- ❖ Approximately four inches in length
- ❖ Tube composed of:
  - Smooth muscle
  - Cartilage rings
- ❖ Lined with mucous membrane and cilia
- ❖ Assists in cleansing, warming, and moisturizing air as it travels to lungs

## Bronchial tree

- ❖ Distal end of trachea divides to form left and right main or primary bronchi
- ❖ Each bronchus enters a lung and branches to form secondary bronchi





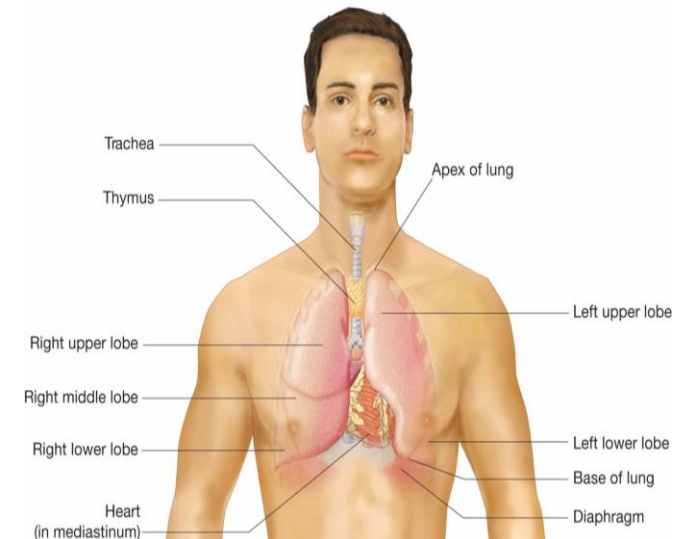
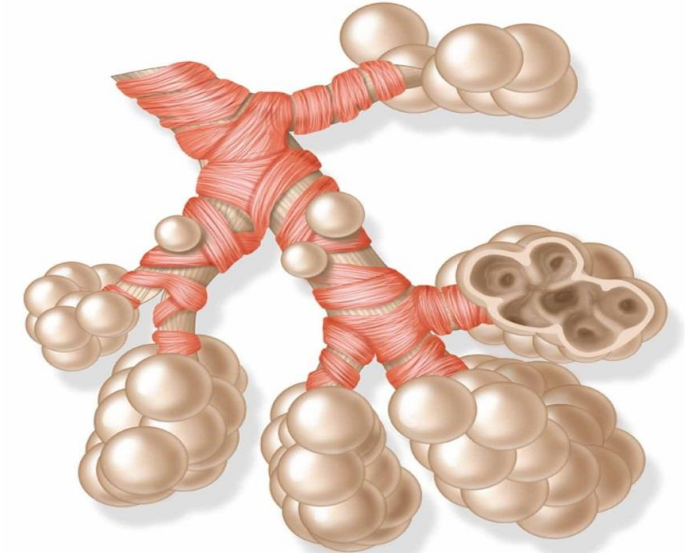
# Organs of Respiratory System

## Alveoli

- ❖ Bronchi continue to branch to form narrow bronchioles
- ❖ Bronchiole terminates in alveoli
- ❖ Approximately 150 million alveoli in each lung
- ❖ Pulmonary capillaries encase each alveolus
- ❖ Alveoli wall + capillary wall forms respiratory membrane for External respiration

## Lungs

- ❖ Each is total collection of bronchi, bronchioles, and alveoli
- ❖ Two lungs: Right lung has 3 lobes & Left lung has 2 lobes
- ❖ Spongy because they contain air
- ❖ Each one has apex, base and hilum
- ❖ Protected externally by the ribs
- ❖ Protected internally by double membrane called pleura



# Organs of Respiratory System

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## Pleura

- ❖ **Parietal** pleura (Outer membrane that lines wall of chest cavity)
- ❖ **Visceral** pleura (Inner membrane that adheres to surface of lungs)
- ❖ Pleura is folded to form a sac around each lung called pleural cavity
- ❖ Serous fluid between two pleural layers reduces friction when two layers rub together during ventilation

## Respiratory muscles

- ❖ **Diaphragm**
  - Muscle separates abdomen from thoracic cavity
  - Contracts and moves down into abdominal cavity
  - Causes decrease of pressure, negative pressure, within chest cavity
  - Air then enters lungs (inhalation) to equalize pressure
- ❖ **Intercostal muscles**
  - Located between ribs
  - Raise rib cage to further enlarge thoracic cavity
  - Increases negative pressure
  - Assists with forceful inhalation



# Terminology

Respiratory System Combining Forms					
<b>alveol/o</b>	alveolus; air sac	<b>bronch/o</b>	bronchus	<b>bronchi/o</b>	bronchus
<b>anthrac/o</b>	coal	<b>bronchiol/o</b>	bronchiole	<b>coni/o</b>	dust
<b>lob/o</b>	lobe	<b>nas/o</b>	nose	<b>epiglott/o</b>	epiglottis
<b>laryng/o</b>	larynx	<b>diaphragmat/o</b>	diaphragm	<b>orth/o</b>	straight, upright
<b>ox/o, ox/i</b>	oxyen	<b>pharyng/o</b>	pharynx	<b>pleur/o</b>	pleura
<b>pneum/o</b>	lung	<b>pneumon/o</b>	lung	<b>Trache/o</b>	trachea
<b>pulmon/o</b>	lung	<b>rhin/o</b>	nose	<b>sinus/o</b>	sinus
<b>Spir/o</b>	breathing	-	-	-	-
Respiratory System suffixes					
<b>-capnia</b>	carbon dioxide	<b>-ectasis</b>	dilated	<b>-osmia</b>	smell
<b>-phonia</b>	voice	<b>-pnea</b>	breathing	<b>-ptysis</b>	Spitting
<b>-thorax</b>	chest	-	-	-	-



# Terminology

<b>Word Building with bronch/o</b>		
<b>-gram</b>	bronchogram	record of bronchus
<b>-itis</b>	bronchitis	inflammation of bronchus
<b>-plasty</b>	bronchoplasty	surgical repair of bronchus
<b>-genic</b>	bronchogenic	produced by bronchus
<b>-scope</b>	bronchoscope	instrument to view bronchus
<b>-spasm</b>	bronchospasm	involuntary muscle contraction of bronchus
<b>-ial</b>	bronchial	pertaining to bronchus
<b>Word Building with bronchi/o and diaphragmat/o</b>		
<b>-ectasis</b>	bronchiectasis	dilated bronchus
<b>-ic</b>	diaphragmatic	pertaining to diaphragm



# Terminology

## Word Building with laryng/o

<b>-ectomy</b>	laryngectomy	surgical removal of larynx
<b>-itis</b>	laryngitis	inflammation of larynx
<b>-plasty</b>	laryngoplasty	surgical repair of larynx
<b>-scope</b>	laryngoscope	instrument to view larynx
<b>-eal</b>	laryngeal	pertaining to larynx
<b>-plegia</b>	laryngoplegia	paralysis of larynx

## Word Building with lob/o & pleur/o

<b>-ectomy</b>	lobectomy	surgical removal of lobe
<b>-centesis</b>	pleurocentesis	puncture of pleura to withdraw fluid
<b>-ectomy</b>	pleurectomy	surgical removal of pleura
<b>-dynia</b>	pleurodynia	pleura pain



# Terminology

Word Building with ox/o and ox/i		
<b>-meter</b>	oximeter	instrument to measure oxygen
<b>an- -ia</b>	anoxia	condition of no oxygen
<b>hypo- -emia</b>	hypoxemia	blood condition of insufficient oxygen
<b>hypo- -ia</b>	hypoxia	condition of insufficient oxygen
Word Building with pharyng/o and pulmon/o		
<b>-itis</b>	pharyngitis	inflammation of pharynx
<b>-eal</b>	pharyngeal	pertaining to pharynx
<b>nas/o -itis</b>	nasopharyngitis	inflammation of nose and pharynx
<b>-logist</b>	pulmonologist	lung specialist
<b>-ary</b>	pulmonary	pertaining to lungs





# Terminology

Word Building with rhin/o		
<b>-itis</b>	rhinitis	inflammation of nose
<b>myc/o -osis</b>	rhinomycosis	abnormal condition of fungus in nose
<b>-plasty</b>	rhinoplasty	surgical repair of nose
<b>-rrhagia</b>	rhinorrhagia	rapid flow (of blood) from nose
<b>-rrhea</b>	rhinorrhea	nose discharge
Word Building with sinus/o & thorac/o		
<b>pan- -itis</b>	pansinusitis	inflammation of all sinuses
<b>-algia</b>	thoracalgia	chest pain
<b>-ic</b>	thoracic	pertaining to the chest
<b>-otomy</b>	thoracotomy	incision into chest



# Terminology

<b>Word Building with –phonia &amp; –capnia</b>		
<b>a–</b>	aphonia	no voice
<b>dys–</b>	dysphonia	abnormal voice
<b>a–</b>	acapnia	no carbon dioxide
<b>hyper–</b>	hypercapnia	excessive carbon dioxide
<b>Word Building with –osmia and -thorax</b>		
<b>an–</b>	anosmia	no smell
<b>hem/o</b>	hemothorax	blood in the chest
<b>py/o</b>	pyothorax	pus in the chest
<b>pneum/o</b>	pneumothorax	air in the chest
<b>Word Building with trache/o</b>		
<b>endo–    –al</b>	endotracheal	pertaining to within trachea
<b>–otomy</b>	tracheotomy	incision into trachea
<b>–stenosis</b>	tracheostenosis	narrowing of trachea



# Terminology

Word Building with -pnea		
<b>a-</b>	apnea	no breathing
<b>brady-</b>	bradypnea	slow breathing
<b>dys-</b>	dyspnea	difficult, labored breathing
<b>eu-</b>	eupnea	normal breathing
<b>hyper-</b>	hyperpnea	excessive (deep) breathing
<b>hypo-</b>	hypopnea	insufficient (shallow) breathing
<b>ortho-</b>	orthopnea	(sitting) straight breathing
<b>tachy-</b>	tachypnea	rapid breathing



# Respiratory system vocabulary

<b>Asphyxia</b>	lack of oxygen; can lead to unconsciousness and death
<b>Aspiration</b>	withdrawing fluid using suction; removing phlegm from patient's airway; inhaling food or liquid into trachea
<b>Clubbing</b>	abnormal widening and thickening of fingers due to chronic oxygen deficiency
<b>Cyanosis</b>	blue skin caused by low oxygen in blood
<b>Epistaxis</b>	a nosebleed
<b>Hemoptysis</b>	cough up blood or blood-stained sputum
<b>Hyperventilation</b>	breathing too fast and too deep
<b>Hypoventilation</b>	breathing too slow and too shallow
<b>Internal medicine</b>	branch of medicine involving diagnosis and treatment of diseases of internal organs; physician is an internist



# Respiratory system vocabulary

<b>Orthopnea</b>	difficulty breathing made worse by lying flat; patient breaths better sitting up
<b>Patent</b>	open or unblocked
<b>Percussion</b>	using fingers to tap on surface to determine condition beneath surface
<b>Phlegm</b>	thick mucus secreted by respiratory tract
<b>Pleural rub</b>	grating sound made when layers of pleura rub together during respiration
<b>Pulmonology</b>	medicine branch involving diagnosis and treatment of respiratory system diseases; physician is a pulmonologist
<b>Rales</b>	abnormal crackling sound during inspiration; indicates fluid or mucus in airway
<b>Rhonchi</b>	musical sound during expiration; caused by bronchial tube spasms
<b>Sputum</b>	phlegm coughed up from respiratory tract
<b>Stridor</b>	harsh, high-pitched breath sound; indicates obstruction in the airway



# Respiratory system vocabulary

Respiratory system pathology	
<b>Croup</b>	acute respiratory condition in children; characterized by barking type of cough
<b>Diphtheria</b>	bacterial infection characterized by formation of thick membranous film across throat; high mortality rate
<b>Pertussis</b>	bacterial infection of upper respiratory system; characterized by whooping cough
<b>Asthma</b>	difficulty breathing caused by bronchospasms, dyspnea, coughing, and wheezing
<b>Bronchiectasis</b>	enlarged bronchi due to destruction of bronchial wall; result of infections
<b>Bronchogenic carcinoma</b>	cancerous tumor originating in bronchi
<b>Adult respiratory distress syndrome (ARDS)</b>	acute respiratory failure; characterized by tachypnea, dyspnea, cyanosis, and hypoxemia
<b>Anthracosis</b>	type of pneumoconiosis; coal dust collecting in lungs; also called black lung or miner's lung
<b>Asbestosis</b>	type of pneumoconiosis; asbestos fibers collecting in lungs
<b>Atelectasis</b>	condition in which alveoli in a portion of lung collapses; prevents gas exchange in lung





# Respiratory system vocabulary

Respiratory system pathology cont.	
<b>Chronic obstructive pulmonary disease (COPD)</b>	progressive, chronic, and usually irreversible group of conditions; like emphysema; lungs have decreased capacity to function
<b>Cystic fibrosis (CF)</b>	genetic condition; produces very thick mucus that causes severe congestion in lungs
<b>Emphysema</b>	chronic lung condition characterized by destruction of alveolar walls
<b>Infant respiratory distress syndrome (IRDS)</b>	most common in premature infants; characterized by tachypnea (called hyaline membrane disease)
<b>Influenza</b>	viral infection of respiratory system
<b>Pneumonia</b>	inflammatory condition of lungs; results in alveoli filling with fluid
<b>Pulmonary edema</b>	excessive amount of tissue fluid accumulating in the lung tissues
<b>Pulmonary embolism</b>	floating blood clot obstructs pulmonary artery; causes infarct of lung tissue
<b><i>Mycoplasma pneumoniae</i></b>	less severe but longer lasting form of bacterial pneumonia; also called walking pneumonia
<b>Pneumoconiosis</b>	accumulation of foreign particles, such as coal dust, in the lungs

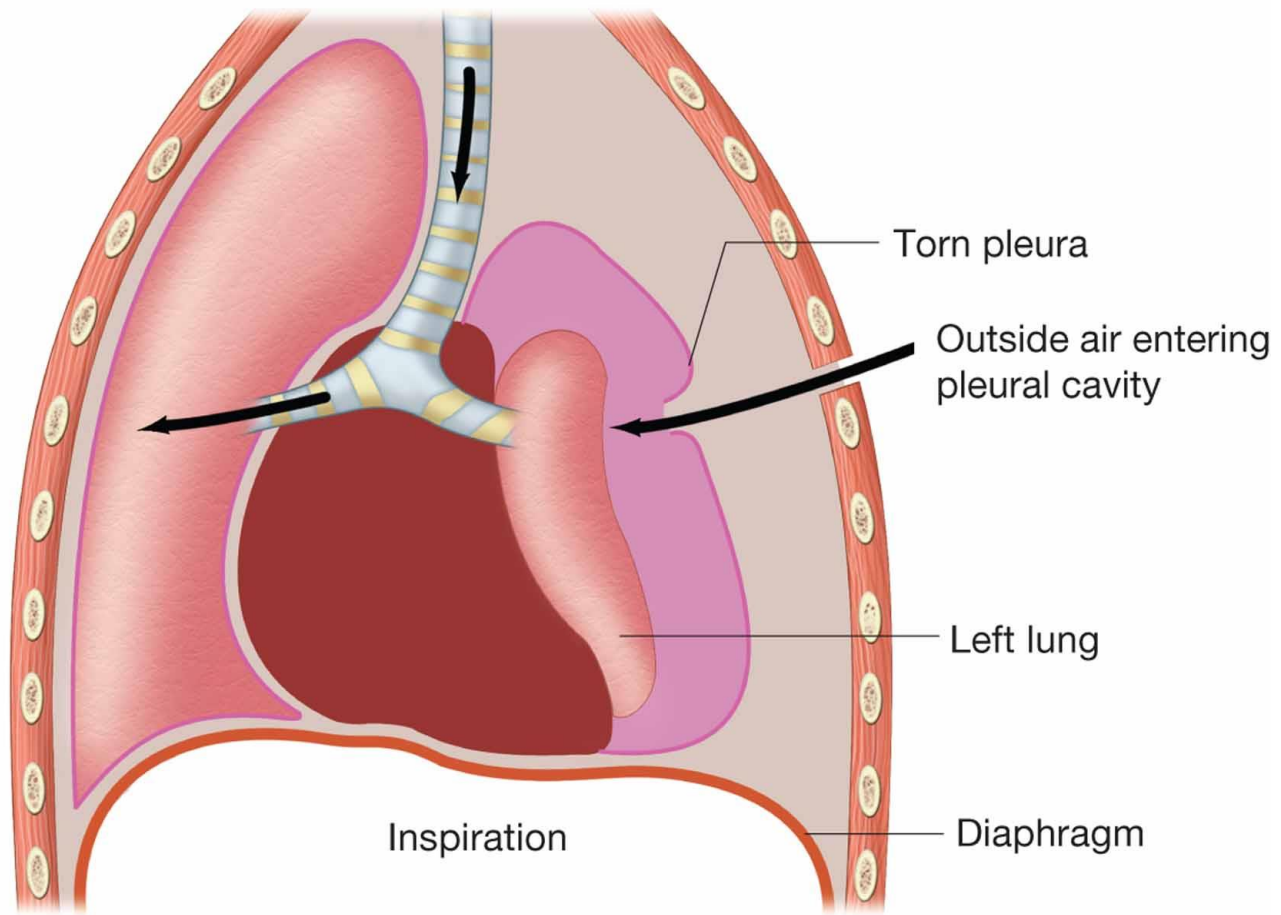


# Respiratory system vocabulary

Respiratory system pathology cont. 2	
<b>Pulmonary fibrosis</b>	formation of fibrous scar tissue in lung; reduced ability to expand lungs
<b>Severe acute respiratory syndrome (SARS)</b>	acute viral respiratory infection; begins like flu but quickly progresses; very high mortality rate
<b>Silicosis</b>	type of pneumoconiosis; accumulation of silica dust in lungs
<b>Sleep apnea</b>	breathing stops repeatedly during sleep; causes drop in oxygen levels
<b>Sudden infant death syndrome (SIDS)</b>	unexpected and unexplained death of apparently well infant; stops breathing for unknown reasons
<b>Tuberculosis (TB)</b>	bacterial lung infection; results in inflammation and calcification of lungs
<b>Empyema</b>	accumulation of pus in pleural space; also called pyothorax
<b>Pleural effusion</b>	accumulation of fluid in pleural cavity; prevents lungs from fully expanding
<b>Pleurisy</b>	inflammation of pleura; characterized by sharp pain with each breath
<b>Pneumothorax</b>	collection of air in pleural cavity; may result in collapsed lung



# Pneumothorax



# Respiratory system vocabulary

Clinical Laboratory Tests	
<b>Arterial blood gases (ABG)</b>	blood test of oxygen and carbon dioxide levels in the blood
<b>sputum culture &amp; sensitivity (C&amp;S)</b>	cultures sputum for bacterial growth, if present, then determines best antibiotic to use
<b>Sputum cytology</b>	examining sputum for malignant cells
<b>Sweat test</b>	test for cystic fibrosis; this disease causes large amount of salt in sweat
<b>Tuberculin skin tests (TB test)</b>	introducing purified protein derivative (PPD) under the skin; determines if person has been exposed to TB
Diagnostic imaging	
<b>Bronchography</b>	X-ray of lung after inhaling radiopaque substance
<b>Chest X-ray</b>	X-ray of the organs of the thoracic cavity
<b>Pulmonary angiography</b>	X-ray of lungs after injecting dye into blood vessel



# Respiratory system vocabulary

<b>Pulmonary function Test</b>	
<b>Oximetry</b>	measures oxygen level in blood; uses oximeter on patient's finger tip
<b>Pulmonary function test (PFT)</b>	group of tests to measure air flow in and out of lungs, lung volumes, and gas exchange
<b>Spirometry</b>	measures lung capacity using a spirometer
<b>Endoscopic procedure</b>	
<b>Bronchoscopy (Bronch)</b>	visual examination of bronchial tubes using a bronchoscope
<b>Laryngoscopy</b>	visual examination of larynx using a laryngoscope
<b>Surgical procedure</b>	
<b>Thoracentesis</b>	surgical puncture of chest wall to remove fluids; also called thoracocentesis
<b>Thoracostomy</b>	insertion of tube (a chest tube) into chest to drain off fluid or air
<b>Tracheostomy</b>	emergency procedure to create an opening directly into trachea so person can breathe easier; also called tracheotomy



# Respiratory system vocabulary

<b>Respiratory therapy</b>	
<b>Endotracheal intubation</b>	placing a tube through the mouth and into the trachea to keep airway open
<b>Postural drainage</b>	drainage of bronchial secretions by placing patient in positions using gravity to promote drainage; cystic fibrosis treatment
<b>Supplement oxygen therapy</b>	providing additional oxygen concentration to improve oxygen levels in bloodstream
<b>Ventilator</b>	machine that provides artificial ventilation for a patient unable to breathe alone
<b>Cardiopulmonary procedure</b>	
<b>Cardiopulmonary resuscitation(CPR)</b>	Emergency treatment given to person when respiration and heart beat stops





# Respiratory system vocabulary

Respiratory System Pharmacology	
<b>Antibiotic</b>	kills bacteria
<b>Antihistamine</b>	blocks histamine released during allergy attack
<b>Antitussive</b>	relieves urge to cough
<b>Bronchodilator</b>	relaxes bronchospasms; treats asthma
<b>Corticosteroids</b>	reduces inflammation of respiratory tract
<b>Decongestant</b>	reduces congestion in respiratory system
<b>Expectorant</b>	improves ability to cough up mucus
<b>Mucolytic</b>	liquefies mucus so it is easier to cough up

