

# Respiratory System

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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
- Must be continuous to meet cells' needs
- Subdivided into three distinct parts:
  - Ventilation
  - Inhalation
  - Exhalation

## **- 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

## **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**

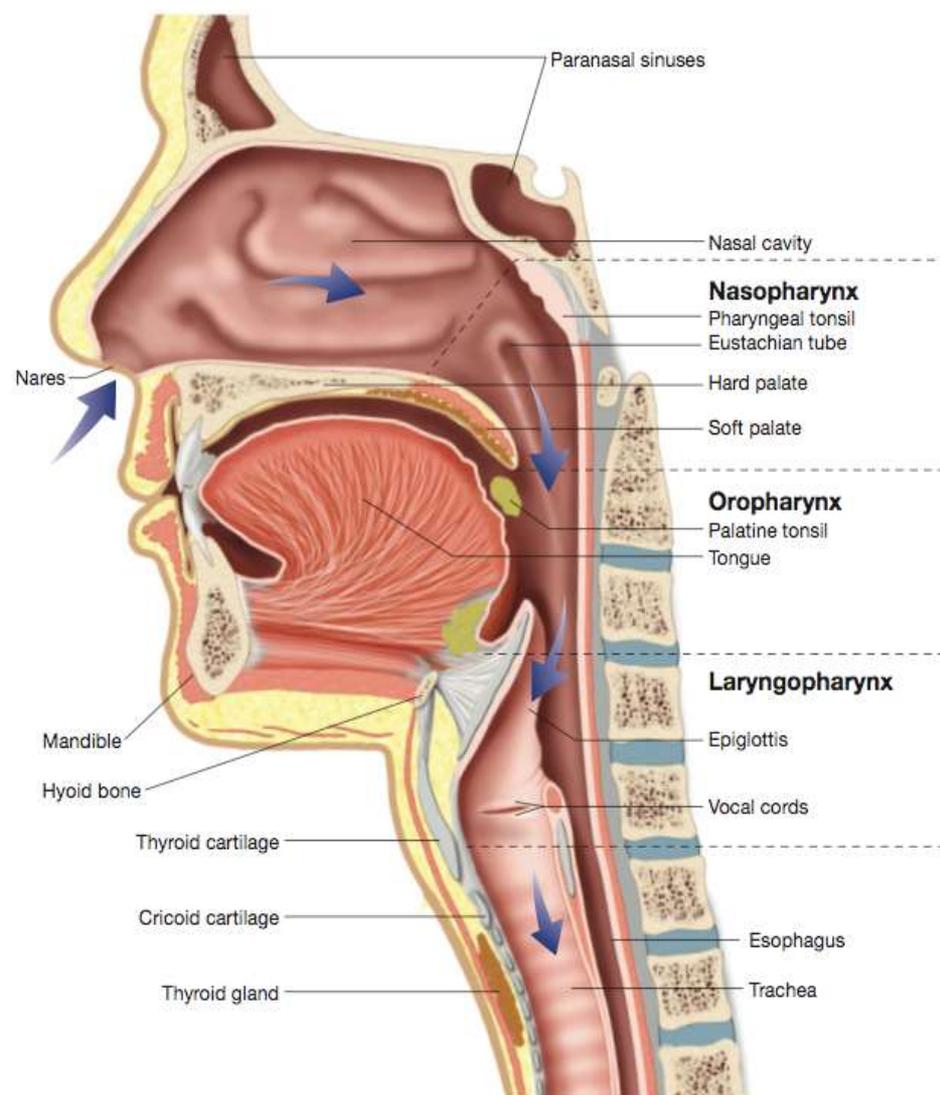
- Located within facial bones
- Echo chamber for sound production
- Gives resonance to voice

# 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)

## **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



## **Vocal cords**

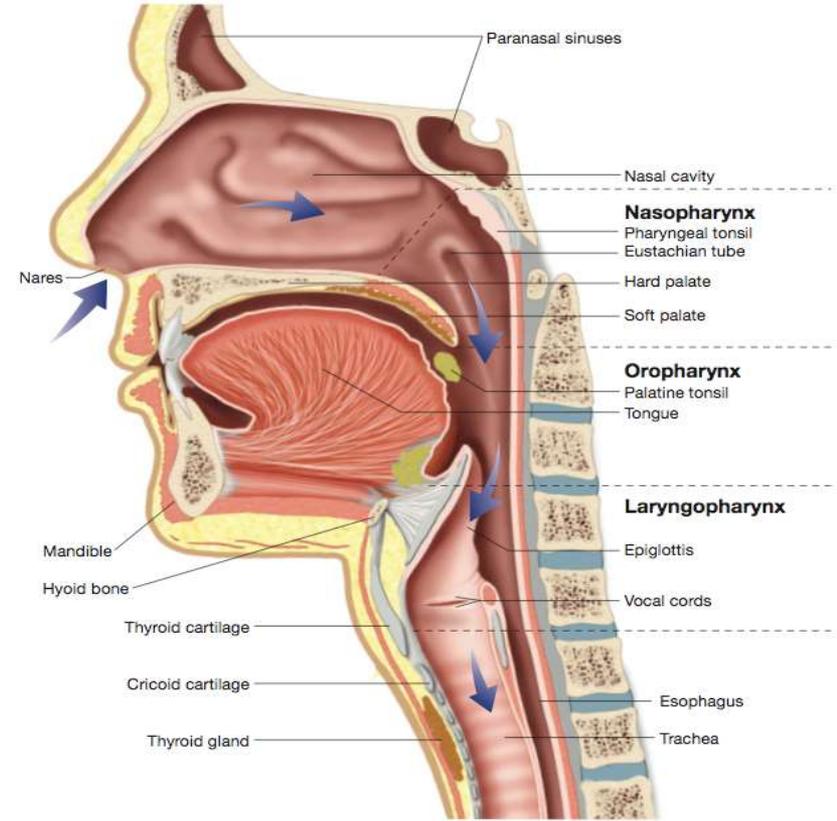
- Folds of membranous tissue
- Not actually cord-like in structure
- Vibrate to produce sound as air passes through opening between folds
- Called glottis

# Epiglottis

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

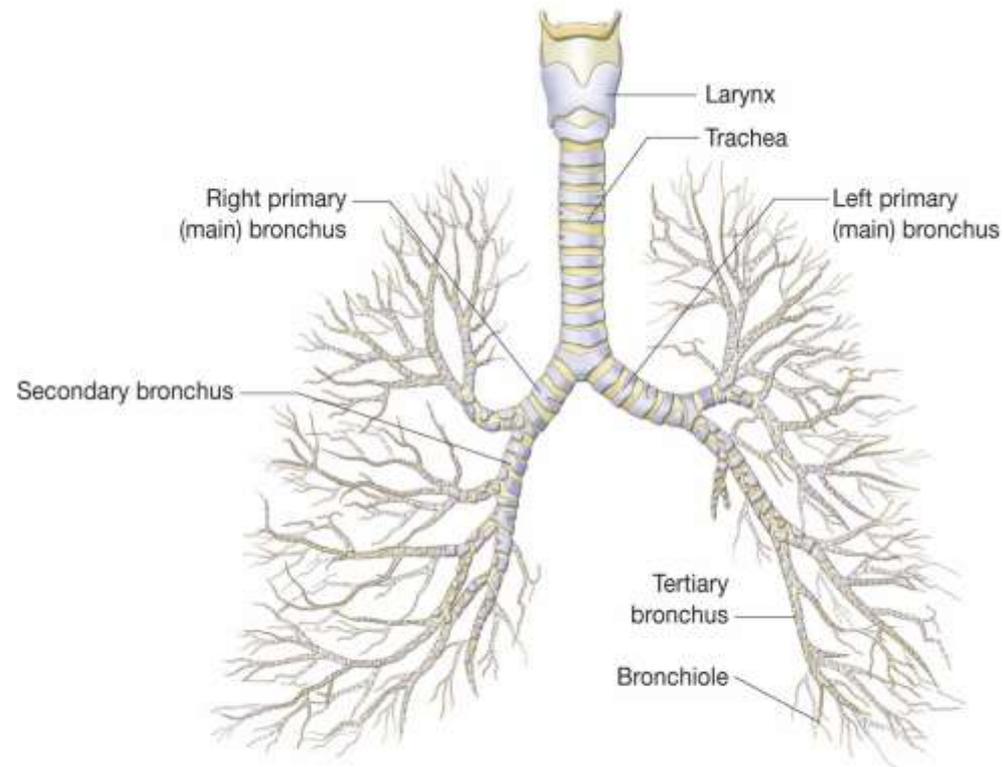
# Trachea

- 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



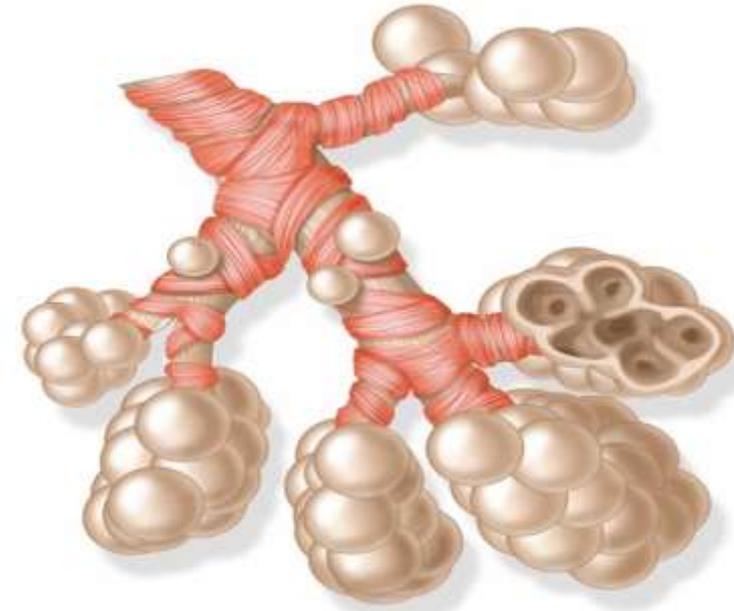
# Bronchial tree

- 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



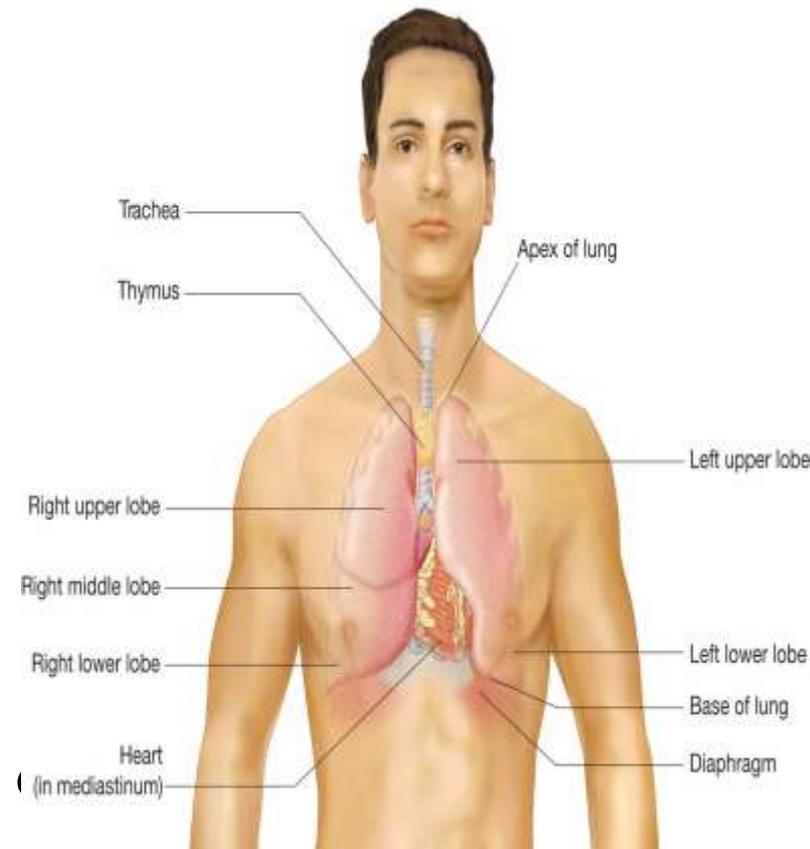
# Alveoli

- 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



# 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

# Respiratory System Combining Forms

alveol/o	alveolus; air sac	bronch/o	bronchus	bronchi/o	bronchus
anthrac/o	coal	bronchiol/o	bronchiole	coni/o	dust
lob/o	lobe	nas/o	nose	epiglott/o	epiglottis
laryng/o	larynx	diaphragmat/o	diaphragm	orth/o	straight, upright
ox/o, ox/i	oxyen	pharyng/o	pharynx	pleur/o	pleura
pneum/o	lung	pneumon/o	lung	Trache/o	trachea
pulmon/o	lung	rhin/o	nose	sinus/o	sinus
<b>Respiratory System suffixes</b>					

–capnia	carbon dioxide	–ectasis	dilated	–osmia	smell
-phonia	voice	-pnea	breathing	-ptysis	spitting
-thorax	chest				

## Word Building with bronch/o

–gram	bronchogram	record of bronchus
–itis	bronchitis	inflammation of bronchus
–plasty	bronchoplasty	surgical repair of bronchus
–genic	bronchogenic	produced by bronchus
–scope	bronchoscope	instrument to view bronchus
–spasm	bronchospasm	involuntary muscle contraction of bronchus
–ial	bronchial	pertaining to bronchus

## bronchi/o and diaphragmat/o

–ectasis	bronchiectasis	dilated bronchus
–ic	diaphragmatic	pertaining to diaphragm

## Word Building with laryng/o

–ectomy	laryngectomy	surgical removal of larynx
–itis	laryngitis	inflammation of larynx
–plasty	laryngoplasty	surgical repair of larynx
–scope	laryngoscope	instrument to view larynx
–eal	laryngeal	pertaining to larynx
–plegia	laryngoplegia	paralysis of larynx

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

–ectomy	lobectomy	surgical removal of lobe
–centesis	pleurocentesis	puncture of pleura to withdraw fluid
–ectomy	pleurectomy	surgical removal of pleura
–dynia	pleurodynia	pleura pain

## Word Building with ox/o and ox/i

–meter	oximeter	instrument to measure oxygen
an–    –ia	anoxia	condition of no oxygen
hypo–    –emia	hypoxemia	blood condition of insufficient oxygen
hypo–    –ia	hypoxia	condition of insufficient oxygen

## Word Building with pharyng/o and pulmon/o

–itis	pharyngitis	inflammation of pharynx
–eal	pharyngeal	pertaining to pharynx
nas/o    –itis	nasopharyngitis	inflammation of nose and pharynx
–logist	pulmonologist	lung specialist
–ary	pulmonary	pertaining to lungs

## Word Building with rhin/o

–itis	rhinitis	inflammation of nose
myc/o –osis	rhinomycosis	abnormal condition of fungus in nose
–plasty	rhinoplasty	surgical repair of nose
–rrhagia	rhinorrhagia	rapid flow (of blood) from nose
–rrhea	rhinorrhea	nose discharge

## Word Building with sinus/o & thorac/o

pan– –itis	pansinusitis	inflammation of all sinuses
–algia	thoracalgia	chest pain
–ic	thoracic	pertaining to the chest
–otomy	thoracotomy	incision into chest

## Word Building with trache/o

endo- -al	endotracheal	pertaining to within trachea
-otomy	tracheotomy	incision into trachea
-stenosis	tracheostenosis	narrowing of trachea

## Word Building with -phonia & -capnia

a-	aphonia	no voice
dys-	dysphonia	abnormal voice
a-	acapnia	no carbon dioxide
hyper-	hypercapnia	excessive carbon dioxide

## Word Building with –phonia and -capnia

a–	aphonia	no voice
dys–	dysphonia	abnormal voice
a–	acapnia	no carbon dioxide
hyper–	hypercapnia	excessive carbon dioxide

## Word Building with –osmia and -thorax

an–	anosmia	no smell
hem/o	hemothorax	blood in the chest
py/o	pyothorax	pus in the chest
pneum/o	pneumothorax	air in the chest

# Word Building with -pnea

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

# Respiratory system vocabulary

asphyxia	lack of oxygen; can lead to unconsciousness and death
aspiration	withdrawing fluid using suction; removing phlegm from patient's airway; inhaling food or liquid into trachea
Cheyne-Stokes respiration	abnormal breathing pattern with long periods of apnea followed by deep & rapid breathing
clubbing	abnormal widening and thickening of fingers due to chronic oxygen deficiency
cyanosis	blue skin caused by low oxygen in blood
epistaxis	a nosebleed
hemoptysis	cough up blood or blood-stained sputum
hyperventilation	breathing too fast and too deep
hypoventilation	breathing too slow and too shallow
internal medicine	branch of medicine involving diagnosis and treatment of diseases of internal organs; physician is an internist

nasal cannula	two-pronged plastic device to deliver oxygen into nose
orthopnea	difficulty breathing made worse by lying flat; patient breaths better sitting up
otorhinolaryngology	branch of medicine involving diagnosis and treatment of diseases of the ear, nose, and throat
patent	open or unblocked
percussion	using fingers to tap on surface to determine condition beneath surface
phlegm	thick mucus secreted by respiratory tract
pleural rub	grating sound made when layers of pleura rub together during respiration
pulmonology	medicine branch involving diagnosis and treatment of respiratory system diseases; physician is a pulmonologist
rales	abnormal crackling sound during inspiration; indicates fluid or mucus in airway
rhonchi	musical sound during expiration; caused by bronchial tube spasms

sputum	phlegm coughed up from respiratory tract
stridor	harsh, high-pitched breath sound; indicates obstruction in the airway
thoracic surgery	medicine branch involving diagnosis and treatment of respiratory system diseases using surgical means

# Respiratory system pathology

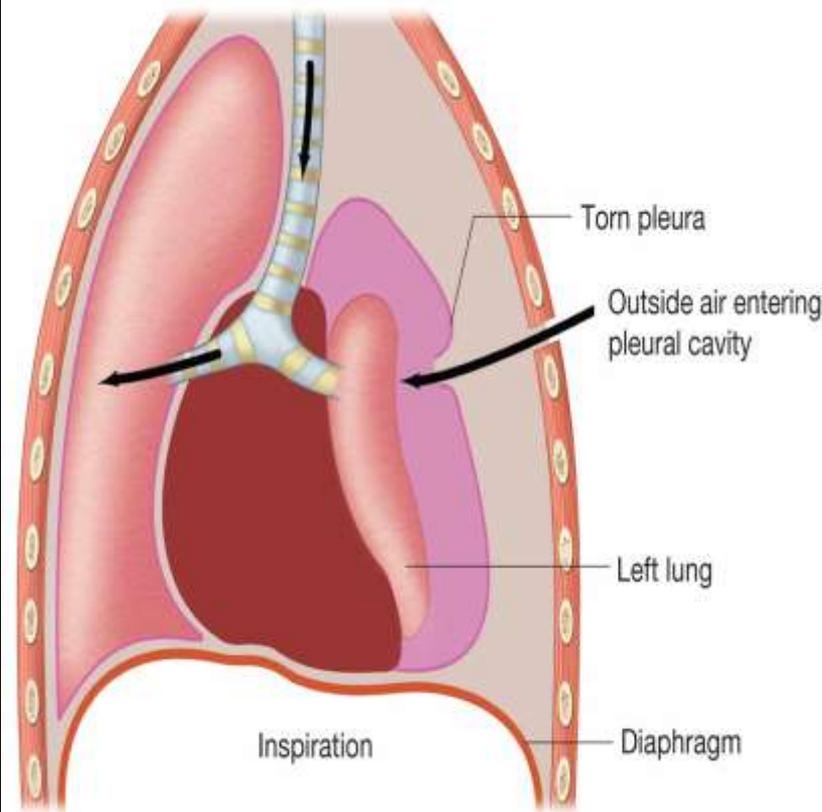
croup	acute respiratory condition in children; characterized by barking type of cough
diphtheria	bacterial infection characterized by formation of thick membranous film across throat; high mortality rate
pertussis	bacterial infection of upper respiratory system; characterized by whooping cough
asthma	difficulty breathing caused by bronchospasms, dyspnea, coughing, and wheezing
bronchiectasis	enlarged bronchi due to destruction of bronchial wall; result of infections
bronchogenic carcinoma	cancerous tumor originating in bronchi
adult respiratory distress syndrome (ARDS)	acute respiratory failure; characterized by tachypnea, dyspnea, cyanosis, and hypoxemia

anthracosis	type of pneumoconiosis; coal dust collecting in lungs; also called black lung or miner's lung
asbestosis	type of pneumoconiosis; asbestos fibers collecting in lungs
atelectasis	condition in which alveoli in a portion of lung collapses; prevents gas exchange in lung
chronic obstructive pulmonary disease (COPD)	progressive, chronic, and usually irreversible group of conditions; like emphysema; lungs have decreased capacity to function
cystic fibrosis (CF)	genetic condition; produces very thick mucus that causes severe congestion in lungs
emphysema	chronic lung condition characterized by destruction of alveolar walls
infant respiratory distress syndrome (IRDS)	most common in premature infants; characterized by tachypnea (called hyaline membrane disease)
influenza	viral infection of respiratory system

pneumonia	inflammatory condition of lungs; results in alveoli filling with fluid
pulmonary edema	excessive amount of tissue fluid accumulating in the lung tissues
pulmonary embolism	floating blood clot obstructs pulmonary artery; causes infarct of lung tissue
<i>Mycoplasma</i> pneumonia	less severe but longer lasting form of bacterial pneumonia; also called walking pneumonia
pneumoconiosis	accumulation of foreign particles, such as coal dust, in the lungs
pulmonary fibrosis	formation of fibrous scar tissue in lung; reduced ability to expand lungs
severe acute respiratory syndrome (SARS)	acute viral respiratory infection; begins like flu but quickly progresses; very high mortality rate
silicosis	type of pneumoconiosis; accumulation of silica dust in lungs

sleep apnea	breathing stops repeatedly during sleep; causes drop in oxygen levels
sudden infant death syndrome (SIDS)	unexpected and unexplained death of apparently well infant; stops breathing for unknown reasons
tuberculosis (TB)	bacterial lung infection; results in inflammation and calcification of lungs

empyema	accumulation of pus in pleural space; also called pyothorax
pleural effusion	accumulation of fluid in pleural cavity; prevents lungs from fully expanding
pleurisy	inflammation of pleura; characterized by sharp pain with each breath
pneumothorax	collection of air in pleural cavity; may result in collapsed lung



# Clinical Laboratory Tests

arterial blood gases (ABGs)	blood test of oxygen and carbon dioxide levels in the blood
sputum culture & sensitivity (C&S)	cultures sputum for bacterial growth, if present, then determines best antibiotic to use
sputum cytology	examining sputum for malignant cells

sweat test	test for cystic fibrosis; this disease causes large amount of salt in sweat
tuberculin skin tests (TB test)	introducing purified protein derivative (PPD) under the skin; determines if person has been exposed to TB

## Diagnostic imaging

bronchography	X-ray of lung after inhaling radiopaque substance
chest X-ray	X-ray of the organs of the thoracic cavity
pulmonary angiography	X-ray of lungs after injecting dye into blood vessel

# Pulmonary function Test

oximetry	measures oxygen level in blood; uses oximeter on patient's finger tip
pulmonary function test (PFT)	group of tests to measure air flow in and out of lungs, lung volumes, and gas exchange
spirometry	measures lung capacity using a spirometer

# Endoscopic procedure

bronchoscopy (Bronch)	visual examination of bronchial tubes using a bronchoscope
laryngoscopy	visual examination of larynx using a laryngoscope

# Respiratory therapy

aerosol therapy	medication suspended in a mist and inhaled; delivered by a nebulizer or metered dose inhaler
endotracheal intubation	placing a tube through the mouth and into the trachea to keep airway open
postural drainage	drainage of bronchial secretions by placing patient in positions using gravity to promote drainage; cystic fibrosis treatment
supplement oxygen therapy	providing additional oxygen concentration to improve oxygen levels in bloodstream
ventilator	machine that provides artificial ventilation for a patient unable to breathe alone

# Surgical procedure

thoracentesis	surgical puncture of chest wall to remove fluids; also called thoracocentesis
thoracostomy	insertion of tube (a chest tube) into chest to drain off fluid or air
tracheostomy	emergency procedure to create an opening directly into trachea so person can breathe easier; also called tracheotomy

# Cardiopulmonary procedure

cardiopulmonary resuscitation (CPR)	emergency treatment given to persons when respiration and heart stop
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# Respiratory System Pharmacology

antibiotic	kills bacteria
antihistamine	blocks histamine released during allergy attack
antitussive	relieves urge to cough
bronchodilator	relaxes bronchospasms; treats asthma
corticosteroids	reduces inflammation of respiratory tract
decongestant	reduces congestion in respiratory system
expectorant	improves ability to cough up mucus
mucolytic	liquefies mucus so it is easier to cough up