

Respiratory System

Includes the nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, alveoli, lungs, pleura and mediastinum.

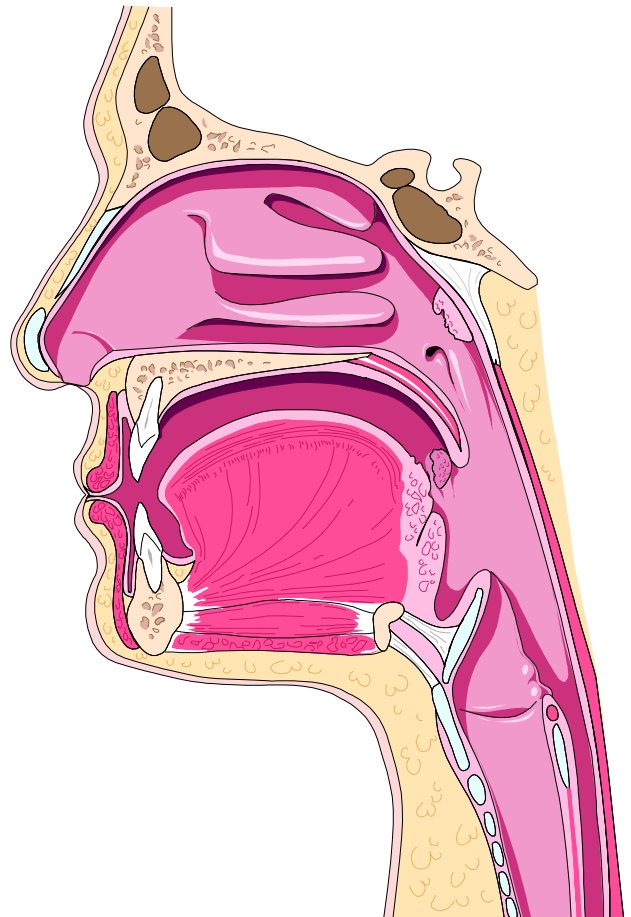
NASAL CAVITY

ANTERIOR NARES =
nostrils

NASAL SEPTUM = divides
nasal cavities into R and L
sides

Turbinates are bones that protrude into the nasal cavity – they increase surface area for filtering dust and dirt particles by the mucous membrane.

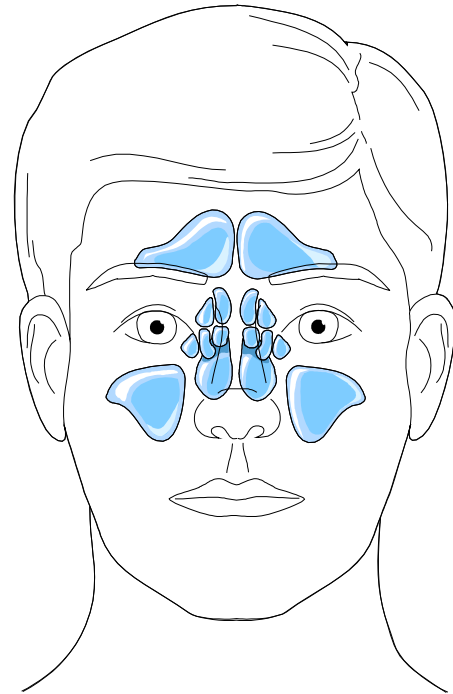
CILIA – the hairs in your nose, trap larger dirt particles



SINUSES – cavities in the skull, ducts connect them to the nasal cavity, lined with mucous membrane to warm and moisten the air.

- Frontal
- Maxillary
- Ethmoid
- Sphenoid

Sinuses give resonance to the voice.



PHARYNX

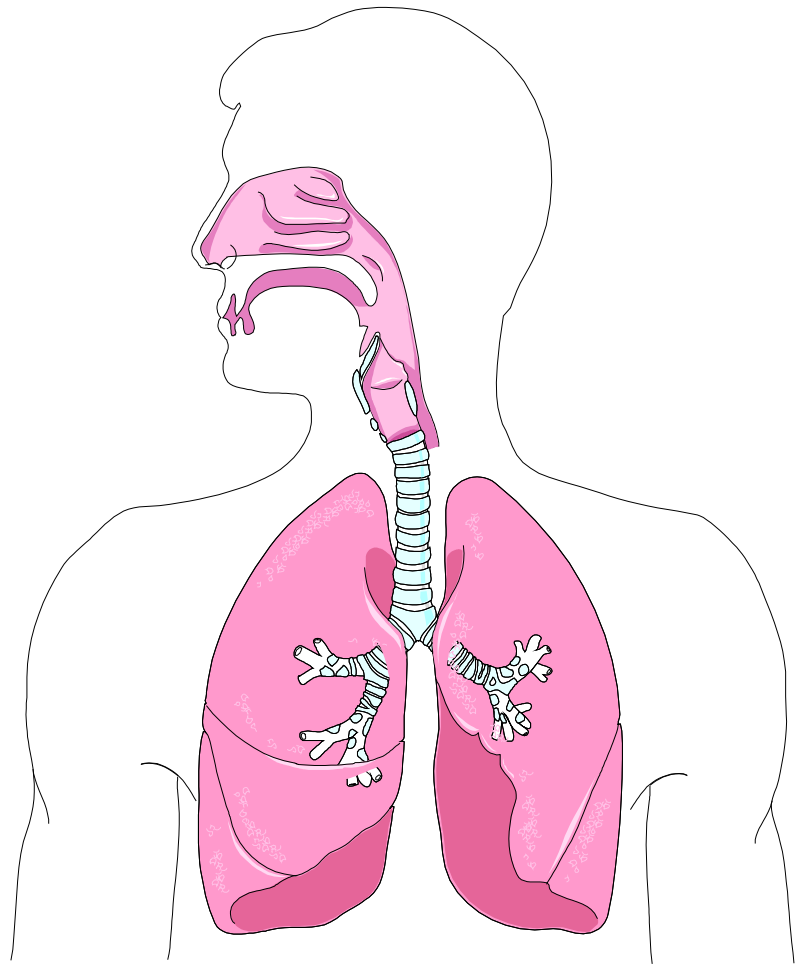
- The throat
- Common passageway for air and food
- 5” long
- Divided into 3 sections
 1. Nasopharynx
 2. Oropharynx
 3. Laryngopharynx
- When food is swallowed, the **EPIGLOTTIS** closes over the opening to the larynx, preventing food from entering the lungs.

LARYNX

- Voice box
- Triangular chamber below pharynx
- Within the larynx are vocal cords (**GLOTTIS**)
- Adam's Apple

TRACHEA

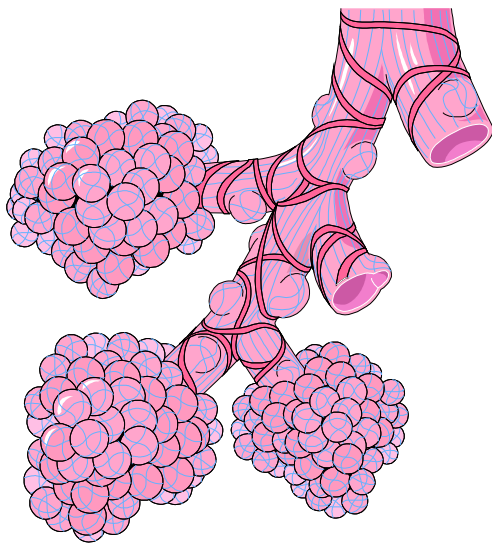
- Windpipe
- 4 ½ in. long
- walls are alternate bands of membrane and C-shaped rings of hyaline cartilage – to keep trachea open
- Lined with ciliated mucous membrane
- Coughing and expectoration gets rid of dust-laden mucous



BRONCHI and BRONCHIOLES

- Lower end of trachea divides into R and L bronchus
- As they enter lungs, subdivide into bronchial tubes and bronchioles
- Bronchi – similar to trachea with ciliated mucous membrane and hyaline cartilage
- Bronchial tubes – cartilaginous plates (instead of C-shaped rings)
- Bronchioles – thinner walls of smooth muscle, lined with ciliated epithelium
- At the end, alveolar duct and cluster of alveoli

ALVEOLI



- Composed of a single layer of epithelial tissue
- Inner surfaces covered with **SURFACTANT** – to keep alveoli from collapsing
- Each alveolus surrounded by capillaries
- O₂ and CO₂ exchange takes place between the alveoli and capillaries (**DIFFUSION**)

LUNGS

- Fill thoracic cavity
- Separated by mediastinum and heart
- Upper part = apex Lower part = base
- Base fits snugly over diaphragm
- Lung tissue porous and spongy – it floats
- R lung = larger and shorter (displaced by the liver) and has 3 lobes
- L lung smaller (displaced by the heart) and has 2 lobes

PLEURA

- Thin, moist slippery membrane that covers lungs
- Double-walled sac
- Space is pleural cavity – filled with pleural fluid to prevent friction

MEDIASTINUM

- Interpleural space
- Contains the Thymus gland, heart, aorta, pulmonary arteries and veins, superior and inferior vena cava, esophagus, trachea, thoracic duct, lymph nodes and vessels

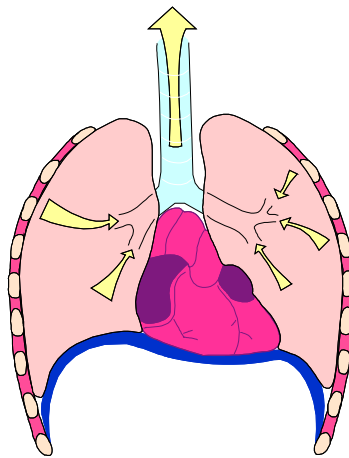
FUNCTION OF THE RESPIRATORY SYSTEM

- External respiration, internal respiration, and cellular respiration
- Production of sound (vocal cords)

PULMONARY VENTILATION (Breathing)

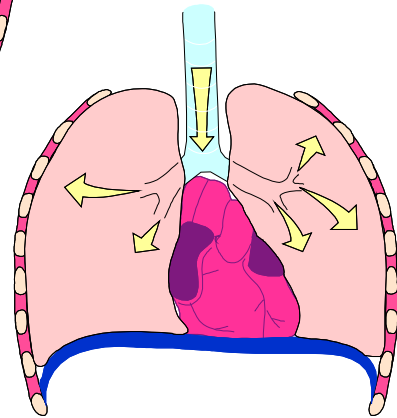
INSPIRATION

- Intercostal muscles lift ribs outward, sternum rises and the diaphragm contracts and moves downward – this increases the volume of the lungs and air rushes in.



EXPIRATION

- Opposite action takes place
- Exhalation is a passive process



Respiratory Movements

- 1 inspiration + 1 expiration = 1 respiration
- Normal adult = 14 - 20 respirations per minute
- Increases with exercise, body temperature, certain diseases.
- Age - newborn = 40-60/min
- Sleep = respirations ↓
- Emotion can ↑ or ↓ rate



Coughing – deep breath followed by forceful expulsion of air – to clear lower respiratory tract.

Hiccups – spasm of the diaphragm and spasmodic closure of the glottis – irritation to diaphragm or phrenic nerve



Sneezing – air forced through nose to clear respiratory tract

Yawning – deep prolonged breath that fills the lungs, increases oxygen within the blood



Control of Breathing

Breathing controlled by neural and chemical factors.

Neural Factors

- Respiratory center located in **MEDULLA OBLONGATA**
- \uparrow on CO_2 or \downarrow O_2 in the blood will trigger respiratory center
- **PHRENIC NERVE** – stimulates the diaphragm

Chemical Factors

- Depends on the levels of CO_2 in the blood (respiratory center in brain)
- Chemoreceptors in aorta and carotid arteries sensitive to the amount of blood O_2

Lung Capacity and Volume

SPIROMETER – device that measures lung capacity

TIDAL VOLUME – amount of air that moves in and out of lungs with each breath. Normal = 500 ml

RESIDUAL VOLUME – amount of air left in lungs that cannot be voluntarily expelled.

Types of Respiration

APNEA – no breathing

DYS/PNEA – difficult, labored or painful breathing

EUPNEA – normal breathing

HYPERPNEA – increase in depth and rate of breathing, abnormal exaggeration of respiratory movements

ORTHOPNEA – difficult breathing when body is in horizontal position

TACHYPNEA – rapid and shallow breathing

HYPERVENTILATION

- rapid breathing causes body to lose CO_2 too quickly, blood CO_2 decreases which leads to alkalosis
- Symptoms: dizziness and possible fainting
- Rx: have person breathe into a paper bag



Respiratory Disorders



PLEURISY

- Inflammation of the lining of the lungs
- Usually occurs in conjunction with pneumonia and other lung infections
- Symptoms – sharp, stabbing pain when breathing, dyspnea and fever

THORACENTESIS – insertion of a needle through the thoracic cavity and into the pleural cavity to drain fluid

PNEUMOTHORAX – collapsed lung due to air in the pleural cavity

COMMON COLD

- Contagious viral respiratory infection
- Indirect causes - chilling, fatigue, lack of proper food, and not enough sleep
- Rx – stay in bed, drink warm liquids and fruit juice, good nutrition
- Also called an Upper Respiratory Infection (URI)

PHARYNGITIS – red, inflamed throat

LARYNGITIS

- Inflammation of larynx or voice box
- Often secondary to other respiratory infections
- Symptoms – sore throat, hoarseness or loss of voice, dysphagia (difficulty swallowing)

SINUSITIS

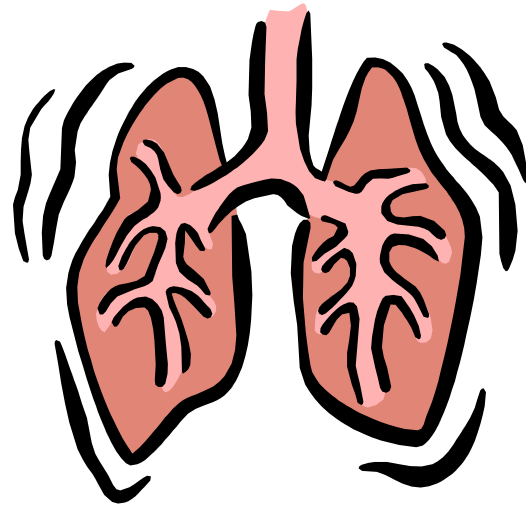
- Infection of mucous membrane that lines sinus cavities
- Caused by bacteria or virus
- Symptoms – headache or pressure, thick nasal discharge, loss of voice resonance
- Rx – analgesics, medications to loosen secretions, surgery for chronic sinusitis

BRONCHITIS

- Inflammation of the mucous membrane of the trachea and bronchial tubes, producing excessive mucous
- May be acute or chronic
- Acute bronchitis characterized by cough, fever, substernal pain and **RALES** (raspy sound)
- Chronic bronchitis – middle or old age, cigarette smoking most common cause

INFLUENZA (Flu)

- Viral infection causing inflammation of the mucous membrane
- Fever, mucopurulent discharge, muscular pain, extreme exhaustion
- Complications – pneumonia, neuritis, otitis media and pleurisy
- Rx – treat the symptoms



PNEUMONIA

- Infection of the lung
- Caused by bacteria or virus
- Alveoli fill with exudate
- Symptoms – chest pain, fever, chills, dyspnea
- Rx – O₂ and antibiotics

TUBERCULOSIS

- Infectious lung disease
- Cause: *Mycobacterium tuberculosis* (a tubercle bacillus)
- May also affect the kidney, bones and lymph
- Tubercles (lesions) form in the lungs
- Symptoms: cough, low grade fever in the afternoon, weight loss, night sweats
- Diagnosis – Mantoux test (skin test)
- If skin test positive – follow up with chest x-ray and sputum sample
- RX – INH

DIPHTHERIA

- Rare infectious disease
- Cause – *Corynebacterium diphtheria*
- Prevented by childhood vaccine



PERTUSSIS (Whooping Cough)

- Symp: severe coughing attacks that end in a “whooping” sound, dyspnea
- Childhood vaccine

Noninfectious Disorders

RHINITIS

- Inflammation of nasal mucosa with increased secretions
- Caused by virus or allergen

ASTHMA

- Inflammatory airway obstruction
- Caused by allergen or psychological stress
- 5% of Americans have asthma
- Symptoms: difficulty exhaling, dyspnea, wheezing, tightness in chest
- Rx: anti-inflammatory drugs, inhaled bronchodilator

ATELECTASIS

- Lungs fail to expand normally due to bronchial occlusion

BRONCHIECTASIS

- Dilation of a bronchus caused by inflammation
- Heavy pus secretion

SILICOSIS

- Cause: breathing dust containing silicon dioxide over a long period of time
- Lungs become fibrosed, reduced ability to expand

NASAL POLYPS

- Growths in sinus cavity, cause obstruction in air pathway
- Rx: surgical removal

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) Describes chronic lung conditions, especially emphysema and chronic bronchitis

EMPHYSEMA

- Alveoli become dilated, lose their elasticity, can't rebound
- May eventually rupture
- Air becomes trapped, can't exhale – forced exhalation required
- Reduced exchange of O₂ and CO₂
- Dyspnea increases as disease progresses

Rx for COPD – alleviate the symptoms, decrease exposure to respiratory irritants, prevent infections, restructure activities to prevent need for O₂

CANCER OF THE LUNGS

- Caused by small cell (oat cell)
- Spreads rapidly to other organs
- Found mainly in smokers
- Other types – squamous cell and adenocarcinoma – don't spread as rapidly
- Symptoms: cough and weight loss
- Diagnosis: x-ray and **BRONCHOSCOPY** (flexible tube passed through mouth or nose into bronchi and lungs)
- Rx: surgery, chemotherapy, and/or radiation

CANCER OF THE LARYNX

- Curable if detected early
- Most common in men over fifty

PULMONARY EMBOLISM

- Blood clot breaks off and travels to the lung
- Occurs after surgery or when a person has been on bed rest
- Symptoms: sudden severe pain in chest, dyspnea
- Diagnosis: lung scan
- Rx: anticoagulant therapy
- Prevention: early ambulation after surgery

SUDDEN INFANT DEATH SYNDROME (SIDS)

- Crib death
- Usually between 2 weeks and 1 year old
- Cause: unknown
- Rx: sleep monitor

EPISTAXIS – nosebleed, treat by pinching nostrils, elevate head and tilt forward, cold packs