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 **EPIGHLOTTIS** 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
- O\textsubscript{2} and CO\textsubscript{2} 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
- ↑ on CO₂ or ↓ O₂ in the blood will trigger respiratory center
- PHRENIC NERVE – stimulates the diaphragm

Chemical Factors

- Depends on the levels of CO₂ in the blood (respiratory center in brain)
- Chemoreceptors in aorta and carotid arteries sensitive to the amount of blood O₂

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
DYSPNEA – 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

HYPERVERVENTILATION
- rapid breathing causes body to lose CO₂ too quickly, blood CO₂ decreases which leads to alkalosis
- Symptoms: dizziness and possible fainting
- Rx: have person breathe into a paper bag
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: *Myobacterium 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

DIPTHERIA
- 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