Human Respiratory System

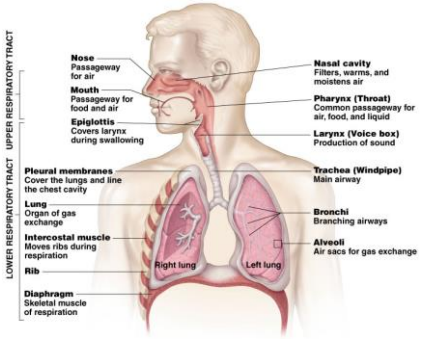


Figure 10.1

Components of the Upper Respiratory Tract

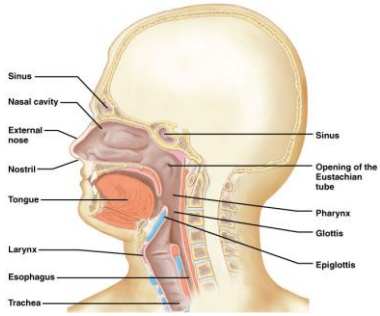


Figure 10.2

Upper Respiratory Tract Functions

- Passageway for respiration
- Receptors for smell
- Filters incoming air to filter larger foreign material
- Moistens and warms incoming air
- Resonating chambers for voice

Components of the Lower Respiratory Tract

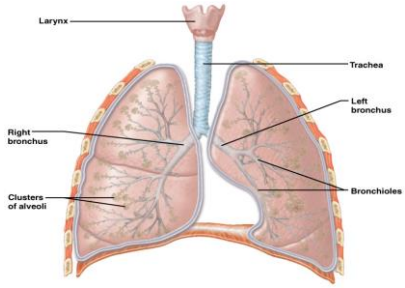


Figure 10.3

Lower Respiratory Tract

- Functions:
  - Larynx: maintains an open airway, routes food and air appropriately, assists in sound production
  - Trachea: transports air to and from lungs
  - Bronchi: branch into lungs
  - Lungs: transport air to alveoli for gas exchange
    - Right lung 3 lobes
    - Left lung 2 lobes

Gas Exchange Between the Blood and Alveoli

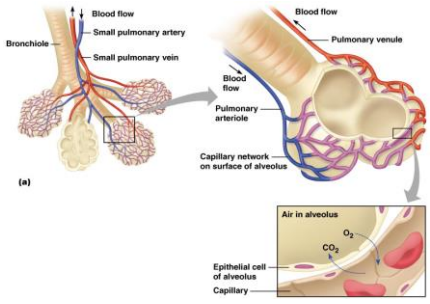
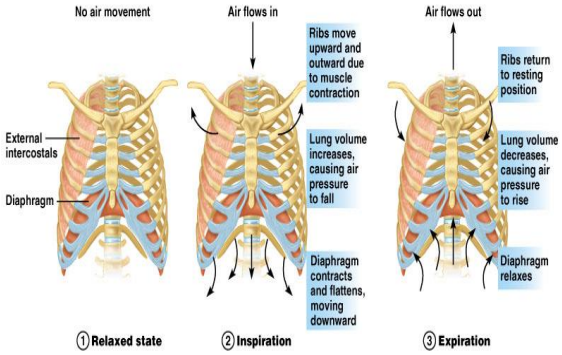
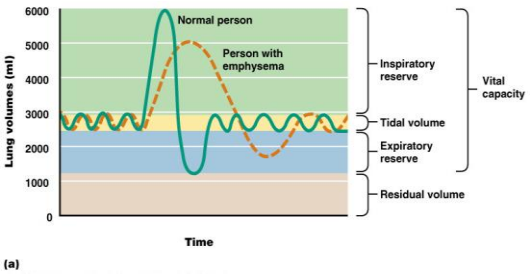


Figure 10.8A

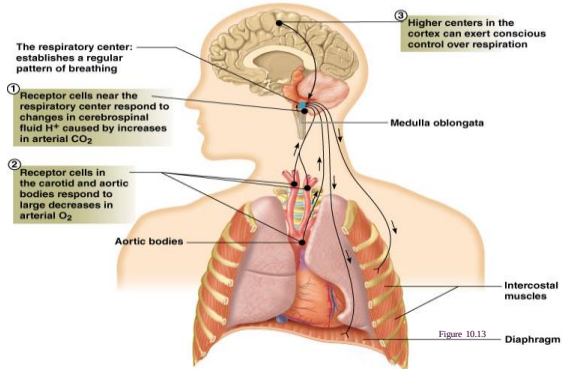
Respiratory Cycle



Measurement of Lung Capacity



Regulation of Breathing



Disorders of Respiratory System

- Reduced air flow: asthma, emphysema, bronchitis
- Infections: pneumonia, tuberculosis, botulism
- Lung cancer
- Congestive heart failure
- Cystic fibrosis

Voice Problems

- Affect millions of people/year
- Impact depends upon
  - Individual
  - Quality of life
- Many people ignore the problem

The shorter the cords, the higher the pitch of voice due to a faster vibration.

Process of Breathing: Pressure Gradient

- Inspiration/Expiration: air in/air out
- Cycle:
  - Relaxed state: diaphragm and intercostal muscles relaxed
  - Inspiration: diaphragm contracts, pulling muscle down, intercostal muscles contract elevating chest wall and expanding volume of chest, lowering pressure in lungs, pulling in air
  - Expiration: muscles relax, diaphragm resumes dome shape, intercostal muscles allow chest to lower resulting in increase of pressure in chest and expulsion of air

Measurement of Lung Function

- Lung volumes and vital capacity
  - Tidal volume: volume of air inhaled and exhaled in a single breath
  - Dead space volume: the air that remains in the airways and does not participate in gas exchange
  - Vital capacity: the maximal volume that can be exhaled after maximal inhalation
  - Inspiratory reserve volume: the amount of air that can be inhaled beyond the tidal volume

Measurement of Lung Function *(cont.)*

- Lung volumes and vital capacity (continued)
  - Expiratory reserve volume: the amount of air that can be forcibly exhaled beyond the tidal volume
  - Residual volume: the amount of air remaining in the lungs, even after a forceful maximal expiration
- Measurement: spirometer

Gas Exchange & Transport: A Passive Process

- Gases diffuse according to their partial pressures
  - External respiration: gases exchanged between air and blood
  - Internal respiration: gases exchanged with tissue fluids
  - Oxygen transport: bound to hemoglobin in red blood cells or dissolved in blood plasma
  - Carbon dioxide transport: dissolved in blood plasma, bound to hemoglobin, or in the form of plasma bicarbonate

Regulation of Breathing: Nervous System Involvement

- Respiratory center in the medulla oblongata: establishes basic breathing pattern
- Chemical receptors: monitor carbon dioxide, hydrogen ions, and oxygen levels
- Medulla: sensitive to hydrogen ions in cerebrospinal fluid resulting from carbon dioxide in blood

Four Respiration Processes

- Breathing (ventilation): air in to and out of lungs
- External respiration: gas exchange between air and blood
- Internal respiration: gas exchange between blood and tissues
- Cellular respiration: oxygen use to produce ATP, carbon dioxide as waste

Developmental Aspects

- **SIDS** (**Sudden Infant Death Syndrome**) in newborns due to failing to breath properly while sleeping.
- Lungs continue to develop throughout early adulthood. Smoking as a teenager causes lung to never completely mature and additional alveoli are lost forever.