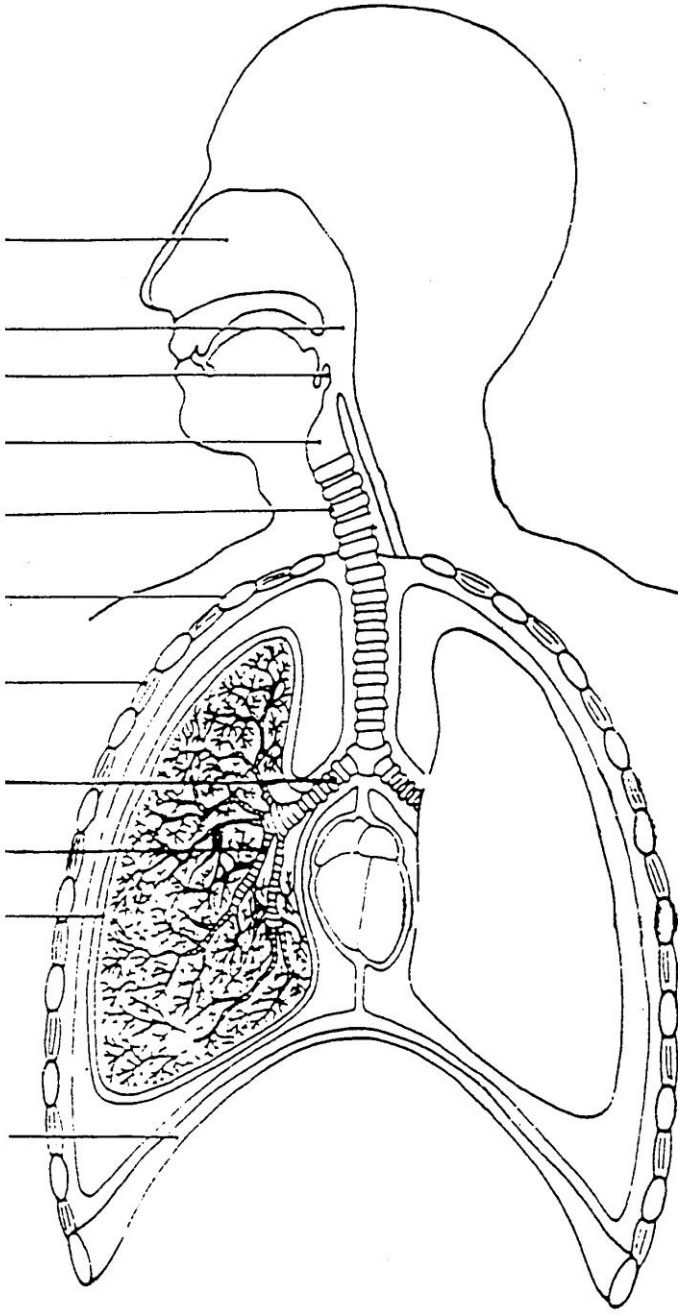
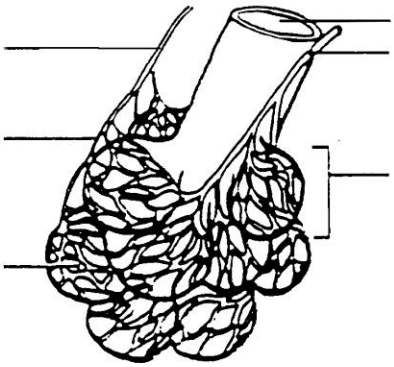
The Respiratory System





Respiratory System: BREATHING

Why Breathe?

- oxygen is necessary for aerobic cellular respiration to generate ATP
- carbon dioxide is a waste product of cellular respiration and must be removed from the body

3-Step Process

(ER) 1. Breathing - muscular actions that move air into/out of respiratory passages
(ER) 2. Gas Exchange - movement of gases (O2 and CO2) by diffusion across cell membranes of alveoli (air sacs)
(IR) 3. Cellular Respiration - use of O2 to produce ATP from glucose; production of CO2 waste gas
(ER: External Respiration - occurs outside of cells)
(IR: Internal Respiration - occurs inside cells)

Mechanics of Breathing

- intercostal muscles attach from rib above to rib below
- lungs are connected to rib cage and diaphragm by pleural membranes
- between pleural membranes is pleural fluid (water-like fluid)

Inspiration (Inhalation)
- intercostal muscles contract pulling rib cage up and out
- diaphragm contracts pulling downwards
- both actions pull on pleural membranes which therefore pull the lungs open
- increased volume in lungs means pressure is reduced (below atmospheric pressure)
- air enters lungs (down pressure gradient)

Expiration (Exhalation)
- intercostal muscles and diaphragm relax allowing rib cage to lower and lungs to decrease in size
- reduced volume in lungs means pressure is increased (above atmospheric pressure)
- air is forced out of lungs (down pressure gradient)

Respiration measurements

Inspiratory reserve volume – amount of air vigorously inhaled
Expiratory reserve volume – amount of air vigorously exhaled
Vital capacity – amount of air vigorously inhaled or exhaled
Tidal volume – amount of air inhaled during normal breaths
Residual volume – the air that is always in the lungs (cannot be exhaled)
Anatomical dead space (air in the tubes)

Disorders of the Respiratory System

Asthma a chronic respiratory disease characterized by inflammation and swelling of the bronchi and bronchioles that obstructs airflow

Chronic obstructive pulmonary disease (COPD) a chronic, progressive disease that involves both obstructive bronchitis and emphysema

Respiratory infections

Influenza: The flu virus may affect the whole body or be confined to the lungs. Symptoms usually include a fever, dry cough, sore throat, runny nose, and muscle and joint aches and pains.

Tuberculosis (TB) a bacterial infection that damages the tissues of the lungs and interferes with gas exchange

Pneumonia an infection of the lungs that causes the alveoli to fill with pus and mucus, preventing gas exchange

cystic fibrosis (CF) is a hereditary disorder in which the gene that influences mucus production is defective. The respiratory system of a person with CF produces unusually thick and sticky mucus that clogs the airways. Like asthma and bronchitis, the airflow to the lungs is reduced. Symptoms include a persistent cough and excess mucus.

• Cigarette and other tobacco smoke is a primary cause of lung disease. Air pollution and airborne irritants are also contributing factors.
• Carbon monoxide and tar from cigarette smoke cause problems in the respiratory and circulatory systems.