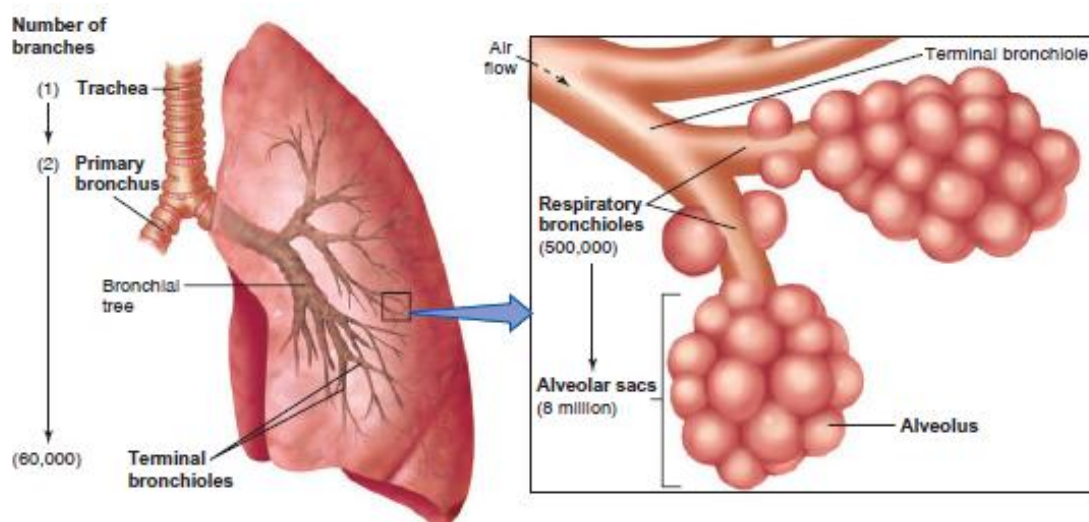


Respiratory System

Respiration is the process by which air is inhaled, oxygen is extracted from it by blood and delivered to the tissues, and carbon dioxide is delivered from the tissues by blood to lungs and then exhaled. Respiration in animals may be anaerobic (utilization of glycogen or glucose in absent of oxygen to obtain energy) or aerobic (utilization of glucose in presence of oxygen to obtain energy).

The respiratory system consists of air passages (two nostrils, two nasal cavities, pharynx, larynx, trachea, two bronchi, and bronchioles), which have no exchange activity, and the lung, comprising alveoli, which are the organs of gas exchange.



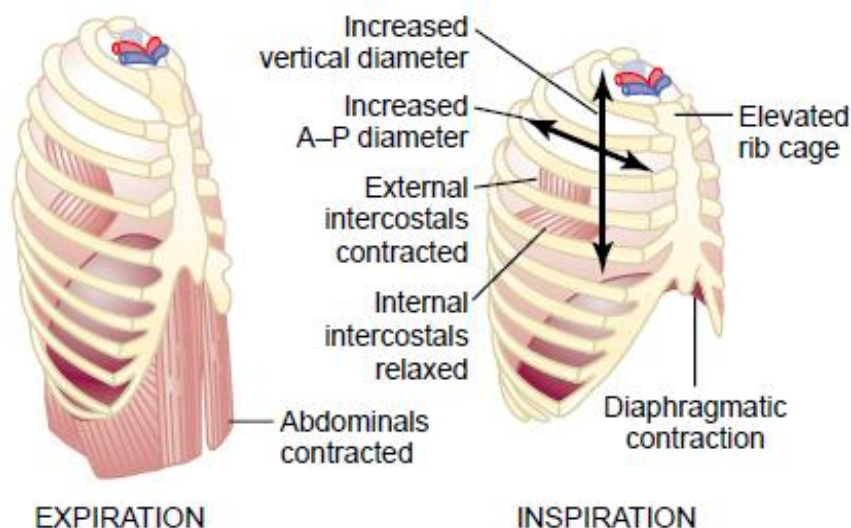
A diagram of the respiratory system

Mechanics of respiration:

Pulmonary ventilation consists of two phases: inspiration and expiration. Inspiration (inhalation) and expiration (exhalation) are accomplished by alternately increasing and decreasing the volumes of the thorax and lungs.

Inspiration results primarily from contraction of the dome-shaped diaphragm, which lowers and flattens when it contracts. This increases thoracic volume in a vertical direction. Inspiration is aided by contraction of thoracic muscles (the parasternal and external intercostals muscles), which raise the ribs when they contract and increase thoracic volume. Contraction of these muscles elevates the ribs in an anteroposterior direction. The increase in thoracic volume decreases intrapulmonary (intra-alveolar) pressure, thereby causing air to flow into the lungs.

Expiration is a passive process. The thorax and lungs recoil as a result of their elastic tension when the respiratory muscles (the internal intercostal muscles) relax. The abdominal muscles also aid expiration because, when they contract, they force abdominal organs up against the diaphragm and decrease the volume of the thorax. The decrease in lung volume raises the pressure within the alveoli above the atmospheric pressure and pushes the air out.



Mechanics of respiration.

Physiology of respiration:

The term **respiration** includes three separate but related functions: (1) ventilation (breathing); (2) gas exchange, which occurs between the air and blood in the lungs and between the blood and other tissues of the body; and (3) oxygen utilization by the tissues in the energy-liberating reactions of cell respiration.

Ventilation and the exchange of gases (oxygen and carbon dioxide) between the air and blood are collectively called **external respiration**. Gas exchange between the blood and other tissues and oxygen utilization by the tissues are collectively known as **internal respiration**.

Ventilation is the mechanical process that moves air into and out of the lungs.

Transport of gases

At the lungs, the oxygen concentration of air is higher in the lungs than in the blood, oxygen diffuses from air to blood.

Carbon dioxide, conversely, moves from the blood to the air. As a result of this gas exchange, the inspired air contains more oxygen and less carbon dioxide than the expired air. Most of oxygen is carried in hemoglobin as oxy-hemoglobin.

At the tissues, the oxygen concentration is low in CO₂ is high.

Carbon dioxide diffuses from the tissues to the blood. CO₂ is carried by plasma and RBCs by 2:1 ratio. CO₂ with plasma water (H₂O) formed carbonic acid (H₂CO₃) that dissociates to bicarbonate (HCO₃⁻) and hydrogen ions (H⁺). Some CO₂ combines with plasma proteins forming carbamino-compounds.

Oxygen utilization

It is the process in which the tissues use the oxygen in metabolism of carbohydrates to obtain the energy.