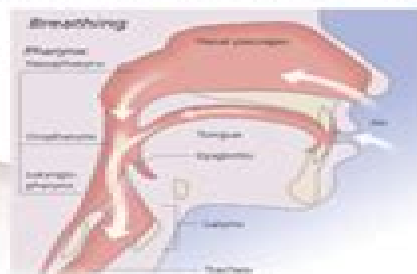
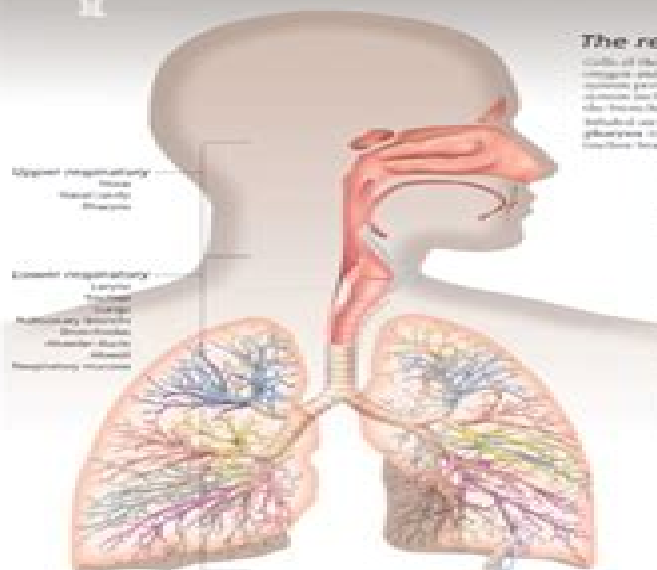




Respiration & Gas Exchange

The respiratory system

Cells of the body get energy through aerobic metabolism, a process that uses oxygen and produces carbon dioxide as a waste product. The respiratory system provides the means for exchanging these gases at the cellular level. The system includes the nose and mouth passages, the pharynx, larynx and trachea, the bronchi and the lungs. Inspired air entering through the nasal cavity or mouth, flows through the pharynx (throat) and the larynx (voice box) to the trachea (windpipe). The trachea branches into two bronchi, which carry air into each of the lungs.



Through breathing, our respiratory system provides the needed oxygen and expels the carbon dioxide we need to eliminate. It completely breathes in (taking in air, inhale) and then expelling it (exhalation).

A normal adult inhales about 14 pints of air per minute while exhales and about 10 pints per minute while exhaling. During exercise or under unusual situations, the body's demand for oxygen increases and the rate of breathing increases.

Total lung capacity

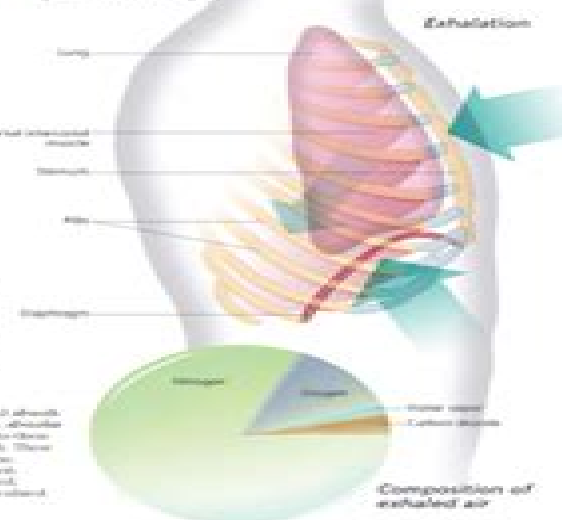
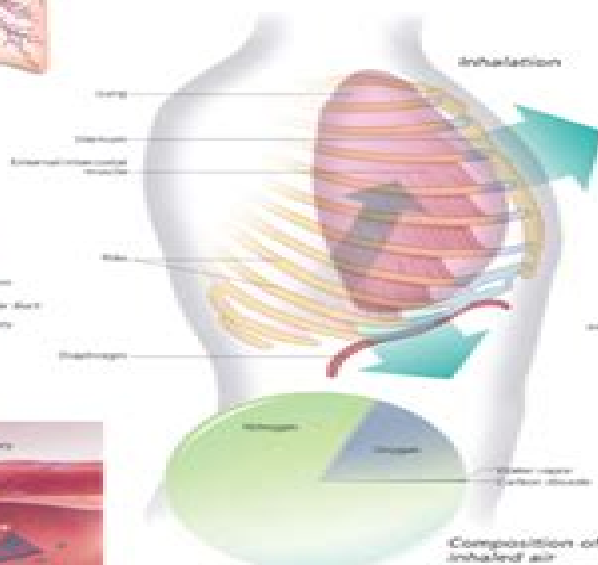


Lung volumes

During normal inspiration, the amount of air breathed in and out is called **tidal volume**. The additional amount of air that can be forcibly inhaled (just a normal inhalation) is the **inspiratory reserve volume**. The additional amount of air that can be forcibly exhaled (just a normal exhalation) is the **expiratory reserve volume**. Together the **inspiratory reserve volume** and the **expiratory reserve volume** make up the **total capacity**. Exhaling all the air in our lungs would create a vacuum, so when we breathe in the lungs, this air is called **residual volume**. Adding the residual volume to the tidal capacity gives us the **total lung capacity** (about 120 pints).

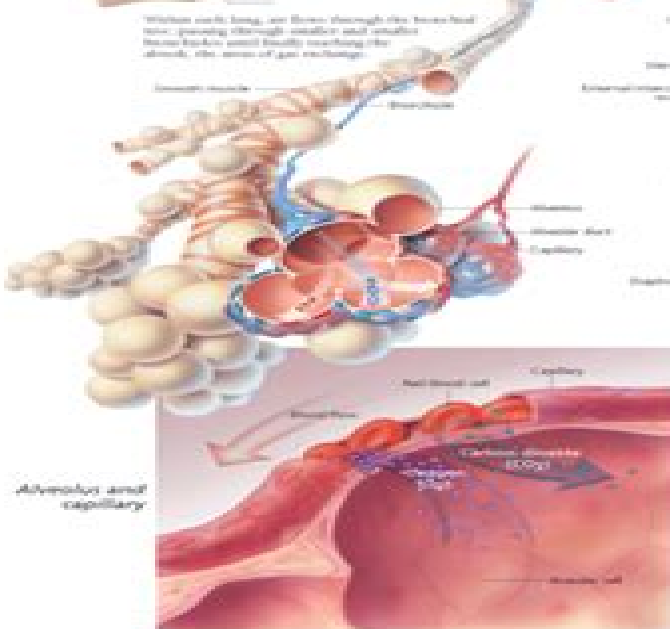
The mechanics of breathing

During inhalation, the diaphragm moves down and contracts, and the external intercostal muscles lift and draw up the rib cage. These actions increase the volume of the chest cavity. A partial vacuum is created by the additional space, and air is drawn in to equalize the pressure. During exhalation, the external intercostal muscles relax, returning the chest cavity. The lungs passively expand and air is pushed out of the lungs.



Gas exchange

Gas exchange occurs in the more than 100 million tiny thin-walled alveoli within the lungs. These alveoli are along the respiratory bronchioles, alveolar ducts and alveolar sacs. Inspired air is carried through the bronchioles to these alveoli. Blood is carried in the capillaries that wrap around all the alveoli. These capillaries are so narrow that blood cells must pass through at a single file. Oxygen (O_2) diffuses across the alveolar wall into the blood cells to capture. Carbon dioxide (CO_2) diffuses from the blood into the alveoli. The CO_2 is exhaled. The newly oxygenated blood travels from the lungs to the heart to be circulated throughout the body.



Respiratory Physiology

Sasha Hu



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