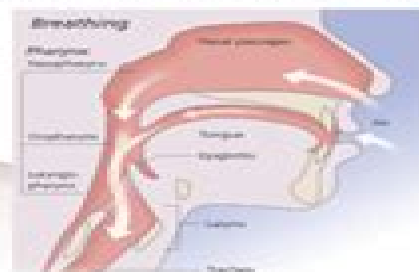
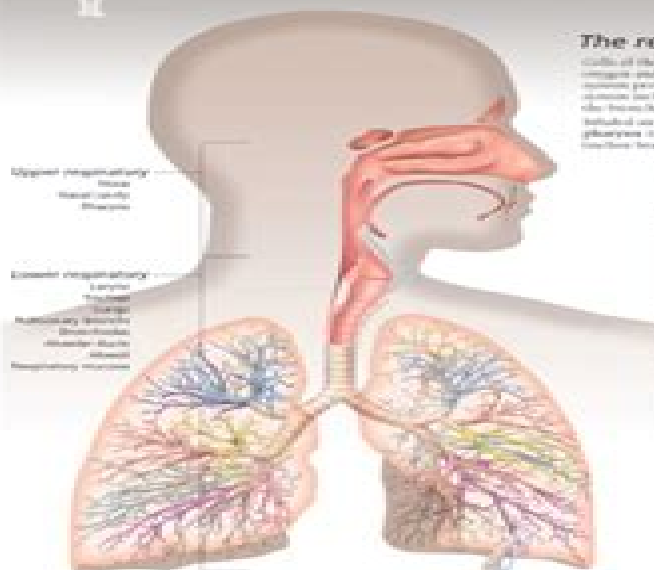




Respiration & Gas Exchange

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/out, taking in oxygen (inspiration) and then expelling it (expiration).

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

Total lung capacity

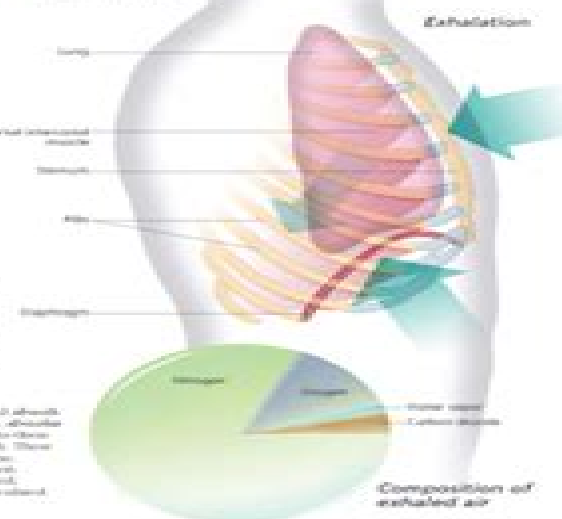
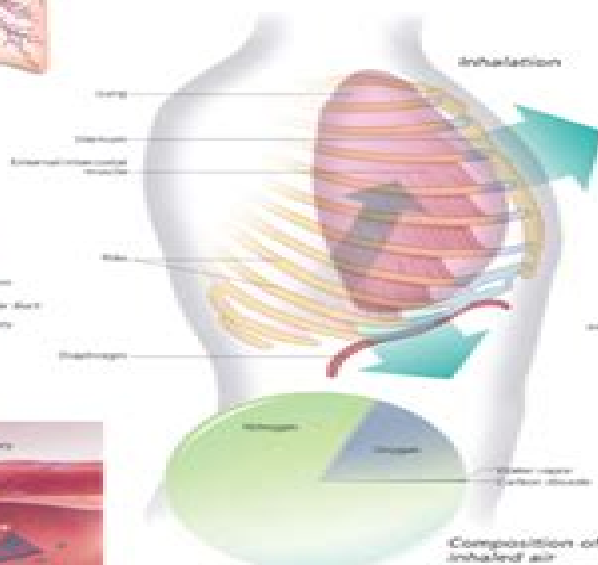


Lung volumes

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).

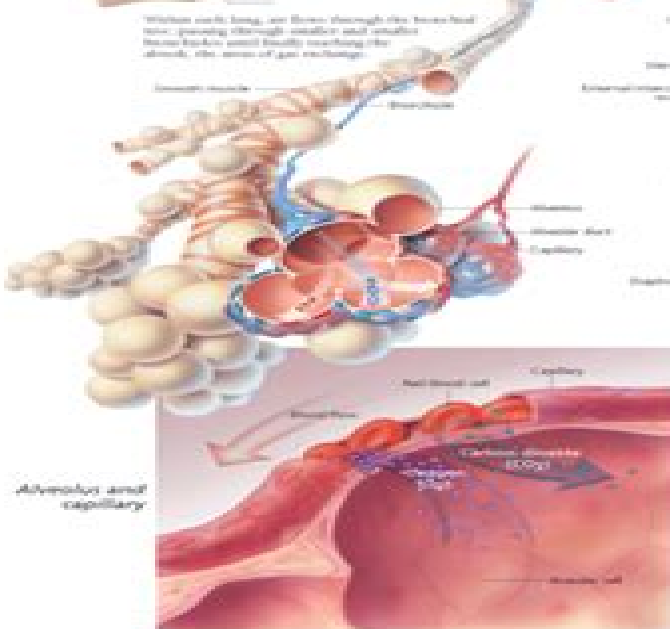
The mechanics of breathing

During inhalation, the diaphragm moves down and contracts, and the external intercostal muscles lift and draw out 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, reducing 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 Understanding Gas Exchange From Basic Principles To Applications

Alan R. Leff, Paul T. Schumacker



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Lung Expansion Olivia Clark,AI,2025-03-18 *Lung Expansion* unveils the science behind optimizing respiratory function to enhance endurance athletic performance and overall well being It highlights that improving lung capacity respiratory muscle strength and breathing control can unlock greater oxygen efficiency within the body Intriguingly targeted training techniques can significantly improve oxygen utilization and the diaphragm and intercostal muscles play a vital role in efficient gas exchange The book uniquely focuses on the often overlooked potential of respiratory training providing a science backed approach to improve breathing mechanics It progresses from fundamental principles of respiratory physiology to practical training techniques increasing lung capacity strengthening respiratory muscles and

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Clinical Anesthesia for the Newborn and the Neonate Usha Saha,2023-01-18 The book covers all aspects of anesthesia in newborns neonates under 28 days and premature babies These patients are highly vulnerable very small in size and weight at very high risk and have high mortality and morbidity which gets further aggravated by the medical diseases and congenital abnormalities these babies may suffer from The book provides knowledge that equips the anesthetists with the regional techniques used to provide both anesthesia and analgesia including information about the drugs used skills in providing neuraxial blocks nerve blocks etc complications thereof and the specially designed equipment for these patients IV cannula endotracheal tubes ryles tubes laryngoscopes SpO2 probes monitors incubators warmers and heaters mattresses OT tables The book covers the pharmacology of drugs used the effect of anesthetic drugs on the developing brain pulmonary physiology airway assessment and management ventilation modes getting IV and arterial access preoperative workup

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Functional Imaging of the Chest Hans-Ulrich Kauczor, 2012-12-06 For a long time imaging of the chest was based on the use of either radiography demonstrating lung morphology or scintigraphy looking at lung function However as a result of recent developments in CT and MRI technology it is now possible to perform dedicated investigations of different aspects of lung function such as ventilation perfusion gas exchange and respiratory mechanics This volume written by acknowledged experts in the field provides a well illustrated and comprehensive review of these novel approaches to functional imaging of the chest It will be of great assistance to all who are establishing such strategies in the research or clinical arenas for the diagnostic work up and follow up of patients with lung diseases

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