

Paper-601. Syllabus—Respiration- Exchanges of gases, oxygen transport, respiratory pigment, oxygen association and dissociation, Transport and removal of C_2O

RESPIRATION

Respiration is a physiological process. During the process oxidation of food stuff occurs and at the same time energy also liberated, which is trapped by forming ATP molecule. The food material we consume, can give us energy through this catabolic process.

Inspiration and expiration of air through our nasal aperture is called breathing. It is the exchange of air between our lungs and the outer environment. In the second phase exchange occur between our lungs and the tissue through blood. The third level is within the cells of tissue and that is actually respiration or cellular respiration.

For terrestrial vertebrates lungs is the vital organ of respiration. Their mode of respiration is called pulmonary respiration. Fishes exhibit branchial (gill) respiration.

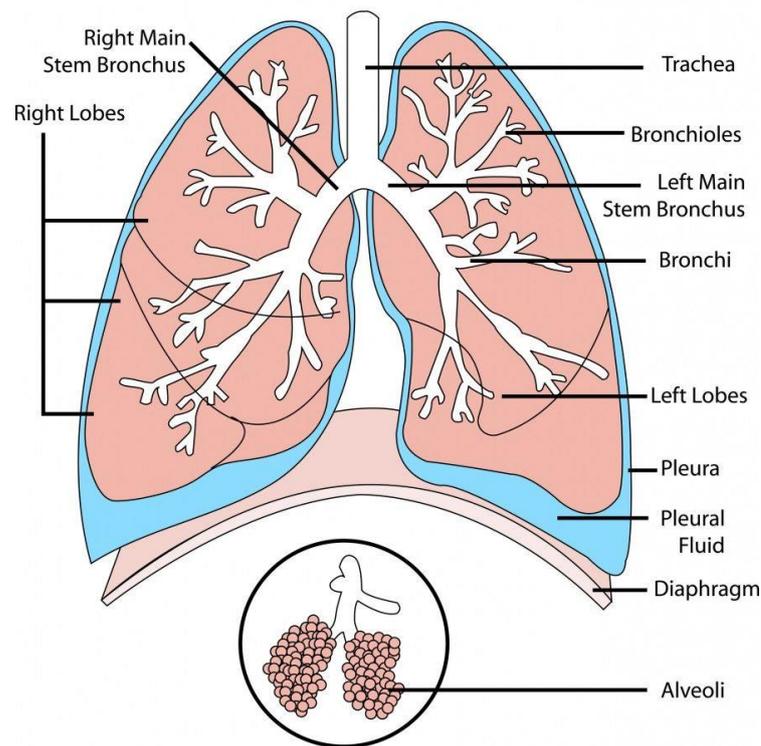
Structure of lungs- Human lung is a pair of conical- shaped organ present in the thoracic cavity. The left lung has two lobes and the right lung has three lobes. Whole lung is covered by a double layered bag, the pleural sac. Outer layer is known as Parietal pleura and the inner layer is called as visceral pleura. The space between the two layers is the pleural cavity which is filled with a fluid secreted by the epithelial cells called, pleural fluid. This fluid and the pleural sac allow the free movement of the lung and prevent the lung from external shock.

Air enters through nostril then goes via pharynx, trachea, bronchus, bronchiol, alveolar duct and finally alveoli. Alveoli are the site of gaseous exchange in lung. The alveoli are very thin walled, composed of squamous epithelium. They are lined by a layer of mucous and closely surrounded by a network of capillaries. The air in the alveoli and the blood in the capillary, practically get separated by only two layers of cells- alveolar epithelial cell and the capillary endothelial cell. This help in the quick absorption of O_2 and elimination of CO_2 in the lung. The alveoli increase the surface area of lung for gaseous exchange.

Mechanism of breathing- Breathing or the level one respiration is a mechanical process. It is composed of two phases- Inspiration and the expiration. Again there are two important muscles of respiration. Diaphragm is one muscle located as the floor of the thoracic cavity and the other important muscle is the Intercostal muscle present between the ribs. Intercostal muscle occurs in two layers –internal and external.

During Inspiration, both the muscles contracted. As a result the dome- shaped diaphragm goes downward and due to contraction of intercostals muscle, the entire rib cage pull upward and forward. Due to combine action of these two muscles volume of thoracic cavity increases , the intra-pleural pressure goes down and the air rush in to the lungs. Again, during expiration these muscles get relax, which decreases the volume of thoracic cavity and the resultant rising of intra-pleural pressure force the air expel out from the lung.

Diagram of the Human Lungs



PHYSIOLOGY OF RESPIRATION

Exchange of gases- During Inspiration and expiration interchange of respiratory gases occur between the blood in the capillaries surrounding the alveoli and the air in the alveoli. This exchange is possible due to the partial pressure difference, because gas move according to the pressure gradient. The atmospheric pressure is 760 mm/Hg at sea level. The pressure is exerted by the gas mixture which makes up the air. They are-

Oxygen -	21%
Nitrogen-	78%
Carbon Dioxide-	0.04%
Rare gases	1%
Water vapour	variable

Partial pressure is the part pressure exerted by the individual gas in the gas mixture or the contribution of pressure exerted by individual gas in the total pressure. The haemoglobin present in the blood plays a vital role in the gaseous exchange. The haemoglobin is therefore well known as the respiratory pigment.

Inhaled air in the lung alveoli has high partial pressure of O_2 (PO_2) then venous blood in the lung capillaries, so, O_2 enter blood. Again the PCO_2 in the capillary blood is higher than the PCO_2 of alveolar air. So, CO_2 release from blood in the lung. The partial pressure differences occur for the gaseous exchange in the lung are-

Gas tension	Alveolar air (mm/Hg)	Venous blood (mm/Hg)
Oxygen	107	40
Carbon dioxide	36	46