

Respiration in Animals

The process by which cells oxidize food materials with the production of energy and release of carbon dioxide is referred to as respiration. Respiration may be Anaerobic or Aerobic. In Anaerobic (also called Fermentation) oxidation of food materials takes place without the utilization of oxygen.

1. Microorganisms like bacteria and yeast depends on anaerobic respiration.
2. Aerobic respiration on the other hand utilize oxygen to oxidize the nutrients for the release of energy. Aerobic respiration is an elaborate process, which involves intake of oxygen, gas transport and utilization of oxygen in the cells to burn the energy rich nutrients and removal of carbon dioxide.
3. For taking oxygen to the body, animals have different types of respiratory structures.
4. Protozoan like Amoeba and Paramecium take oxygen through the general body surface.
5. Sponges and Coelenterates also obtain oxygen through the body surface.
6. Annelids like Earthworm takes oxygen through the skin but Neries has Parapodium for aquatic respiration.
7. Crustaceans possess Gills and Insects possess Trachea as respiratory organs. In Scorpions Book lungs function as respiratory organs.
8. Ctenidia of Molluscs and Tube feet of Starfish functions as respiratory organs.

Mammalian respiratory system

Mammals have well developed respiratory system for gas exchange. In man the respiratory system consists of air passage and lungs.

Air passage includes nasal cavity, pharynx, and trachea. The Larynx (Voice box) is the enlarged portion of the trachea, which produces sound. The wall of larynx is supported by three cartilages namely Thyroid, Cricoid and Arytenoid. Inside the larynx there are vocal cords, which vibrate when air passes through them and produce sound. Trachea is internally lined with pseudostratified ciliated squamous epithelium. Trachea divides into two bronchi and each bronchus further divides into bronchioles each ends in air sacs or Alveoli. Lungs are elastic structures protected by a double membrane bag called Pleural sac. The bronchioles and alveoli constitute the structure of lungs. Alveoli are thin walled and vascularised structures for gas exchange.

The respiratory process involves Inspiration, Gas exchange and Expiration. Inspiration is an active process by which air is drawn into the lungs. Diaphragm, Intercostals muscles, ribs etc. plays a vital role to increase the volume of thoracic cavity for inhalation. Expiration is a passive process by which impure air is removed from the lungs.

Gas exchange takes place between the air and blood in the lungs and between blood and cells. Oxygen is exchanged for Carbon dioxide in the lungs based on the Partial pressure and Tension gradient of gases. Oxygen is transported as Oxyhaemoglobin by the blood. Carbon dioxide transport occurs mainly as Bicarbonates. Carbonic anhydrase enzyme (fastest enzyme) converts Carbon dioxide into Carbonic acid in the RBC. Chloride shift or Hamburger phenomenon is the movement of chloride ions into RBC from the plasma to maintain the electrical potential of the RBC membrane.

Respiratory Pigments

These are blood pigments facilitates the transportation of Oxygen. Haemoglobin (present in RBC in vertebrates and in the Plasma of Earthworm) is the most common blood pigment. Hemocyanin is a blue coloured copper containing pigment found in Crustaceans (Prawn). Chlorocruorin (Green) is an iron containing pigment in Sabella (Annelid). Pinnaglobin (Brown) is Manganese pihent found in Pinna (Mollusc). Vanadium pigment is seen in Ascidia.

Respiratory center is located in the Medulla and Pons. Inspiratory center is present in the dorsal side of medulla and the expiratory center (connected with Vagus nerve) on the ventral side. The Pneumotaxix center (control breath rate) is located in the pons varoli. The wall of bronchi has stretch receptors, which are stimulated by the stretching. This develops Hering – Breuer reflex to prevents excessive lung inflation.

Hypoxia is the condition in which there is severe shortage of oxygen in the body. Asphyxia refers to increase in CO₂ content in the cells. Cyanosis is the blueness of the skin due to excess deoxygenated haemoglobin in the body. Surfactant is a mixture of phospholipids, proteins and ions secreted by the alveolar (type II) cells. It reduces the surface tension in the lungs.