CHAPTER NO. 14
RESPIRATION
KEY POINTS

- Gaseous exchange occurs by the physical process of diffusion.
- External feature of nose depends upon ethmoid bone and cartilage.
- Nose is composed of bone, cartilage (Hyaline) and fibro fatty tissues.
- Underneath Mucous membrane, there are blood capillaries that help to warm up air up to 30 °C.
- Pharynx is cone shaped and 4.5 inch in length.
- Adam apple is also called Larynx or Sound or voice box.
- Two fibrous bands located in larynx are called vocal cords.
- Trachea is also called as wind pipe, which is 10-12cm long (4-6inch) and 2cm wide (¾ inch).
- The forked part of trachea is bronchi.
- Right bronchus has larger diameter and is shorter than left one (due to liver).
- Bronchioles are 1mm in diameter and consists of ciliated cuboidal epithelium and smooth muscles.
- Collection of air sacs is called alveoli.
- Bronchioles are elastic.
- Wall of alveoli is 0.1 μm thick.
- Collagen and elastic fibre in alveoli allow it to expand.
- There are 700 million alveoli present in lungs, representing a total surface area of 70-90m².
- Lungs are located in thoracic cavity.
- Phonetics is only due to exhalation.
- Right lung represents 56% of total lung volume and left lung represents 44% of total volume.
- Right lung is 30% larger than left one.
- Weight of adult human lung is 1.3 kg.
- Lung cells are called Pneumocytes.
- Line that divide lobes in lungs is called fistula (superficial depression).
- Diaphragm is sheath of skeletal muscle.
- Lung is composed of double layered pleura Membrane in which visual pleural is under body skin.
- Pleura is serous membrane.
- Surfactants are lipoprotein complex.

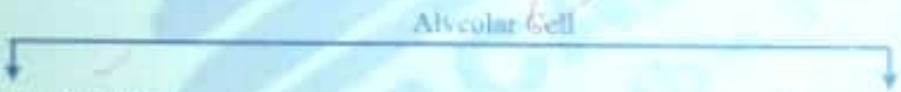

Fig 14.1: Types of Alveoli

- Exchange of gases occurs in type 1 cells.
- Surfactants are produced in type 2 cells.
- Adult human has lung capacity of 5 litre.
- Breathing canter is located in medulla oblongata and pons.
- Ventral portion of breathing centre is called inspiratory centre while dorsal and lateral portion is called expiratory centre.
- About 20% decrease in oxygen concentration in air produce a doubling in breathing rate.
- Breathing centre is also called Respiratory Rhythm Generator.
- Intercostal muscle is a skeletal muscle.
- Phrenic nerve stimulate diaphragm which is $C_3 - C_5$ (cervical spinal root nerve).
- Diaphragm acts as a piston muscle.
- Suction during inhalation is done through diaphragm.
- During inhalation diaphragm moves downward and thoracic cavity increases.
- Inspiration is active while expiration is passive process.
- 97% Oxygen is carried out by RBCs and 3% by plasma.

- $Hb + 4O_2 \rightleftharpoons HbO_8$
- Hb concentration is 15g/100ml of blood.
- 1 gram of Hb carries 1.34ml of Oxygen (Heffner's constant)
- 100ml of arterial blood contain 19.4ml O_2 (97% saturated, PO_2 95 mmHg).
- 100ml of venous blood contains 14.4ml O_2 (75% saturated, PO_2 40 mmHg).
- 5ml of O_2 is released to tissue by each 100ml of blood.
- During exercise venous blood have 4.4ml O_2/100ml of blood in active tissues (PO_2 is 18mmHg).
- Blood plasma contain 0.29ml O_2/100ml of blood plasma (PO_2 95mmHg) and may be increased up to 0.3ml at 100mmHg.
- Venous blood plasma has 0.12ml O_2(PO_2 is 40 mmHg)
- 0.17ml of O_2 is transported by each 100ml through tissues in dissolved state (plasma).
- 70% CO_2 transported as bicarbonations
- 23% of CO_2 is transported in the form of carbaminohaemoglobin
- 7% CO_2 transported as plasma
- Hamburger's phenomenon or chloride shift occurs during CO_2 transportation by RBC.
- Haemocyanin is found in Molluscs which is blue in colour when oxygenated and almost colour less when de oxygenated.
- Chlorocruorin is found in annelids which turns green when oxygenated
- Haemoerythrin is found in marine animals which is violet to pink colour when oxygenated and colour less when deoxygenated.
- Haemoglobin is bright red when oxygenated and dark red when deoxygenated
- Haemoglobin is a metalloprotein (574) Amino acid and 4 Polypeptide chain.
  (α *chain* = 141 *amino acids,* β *chain* = 146 *amino acids*)
- Myoglobin is oxygen storing molecule. (1 polypeptide chain + 153 amino acid)
- Acute sinusitis = 2-8 weeks.
- There are four large sinuses:
  Two in cheek bones i.e maxillary sinuses
  Two above the eyes i.e frontal sinuses, of sinuses
- Eustachian tube equalizes pressure between middle ear and outside.
- Major causes of otitis media are allergic infection, nutritional deficiency and blockage of Eustachian tube.
- 80% otitis media clears up with in 3-4 days without any treatment.
- In auriscope or otoscope, convex lens is used
- There are 30 different causes of pneumonia but common is bacterial infection (mycoplasma).
- Hyponatremia → low sodium level in blood
- T.B is transmitted through airborne droplets
- M. tuberculosis is a bacillus bacterium
- TB treatment → Rifampin, Isoniazid, BCG
- Lung cancer may be treated through chemotherapy, radiations and surgery
- Mucous is secreted by goblet cells of mucous membrane
- Underneath the mucous membrane there are blood capillaries that warms air upto 30°C depending upon the external temperature
- Pharynx is a part of both digestive and respiratory system
- Vocal cords are composed of mucous membrane
- Adult males have large vocal cords and usually low-pitched voices
- Bronchioles are the first airway branches that does not contain cartilage are responsible for air distribution in lungs.
- Right lungs are composed of three lobes i.e superior, middle and inferior.
- Surfactant lower the surface tension of fluid layer lining the alveolus.
- Pleura protect the lungs stop them leaking air into the thoracic cavity and reduce friction between the lungs and wall of thorax.
- Spirometer is a device used to measure lung capacity.
- Tidal volume is the volume of air exchanged during one breath in and out
- Residual volume is the volume of air remained in lungs after forcible expiration

- 97% O_2 is carried by RBC as oxyhemoglobin
- Hemoglobin can bind with four O_2 molecules
  Myoglobin binds with one O_2 molecule, so Mb is more efficient because of rapid function
- The amount of O_2 released to tissue by active tissue (during exercise) is 15ml
- For children with recurrent serve middle air infection (otitis media) tiny tubes may be inserted through the eardrum to help drain fluid these tubes are called grommets or tympanostomy tubes
- Sometime a small hole is made in ear-drum surgically to allow fluid to drain out, this surgical operation is myringotomy
- Bacteria that causes bacterial pneumonia are streptococcus pneumonia haemophilus influence legionella pneumophila staphylococcus aureus and mycoplasma
- Complication of untreated pneumonia are:
  - Plural effusion (fluid around lung)
  - Empyema (pus in the pleural cavity)
  - Hyponatremia (low blood sodium)
- Emphysema is a lung disorder in which alveoli is damaged and bronchi become damaged and narrowed
- Cyanosis is a blue tinge to skin due to lack of oxygen