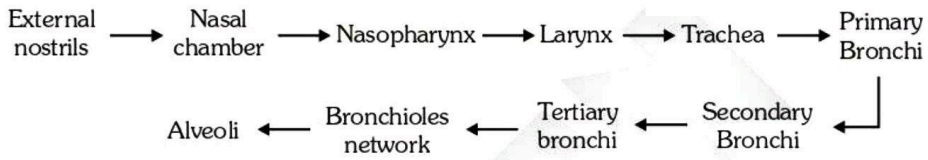
BREATHING AND EXCHANGE OF GASES

- The process of exchange of O_2 from the atmosphere with CO_2 produced by the cells is called breathing, commonly known as respiration.

S.No.	Respiratory organs	Examples
1	General body surface	Sponges, Coelenterates, Flat worms
2	Moist skin	Earthworms, Frogs
3	Tracheal tubes	Insects
4	Gills	Aquatic arthropods, Molluscs, Fishes
5	Lungs	Reptiles, Birds, Mammals

- Pharynx is the common passage for food and air.
- In human, path of air is :



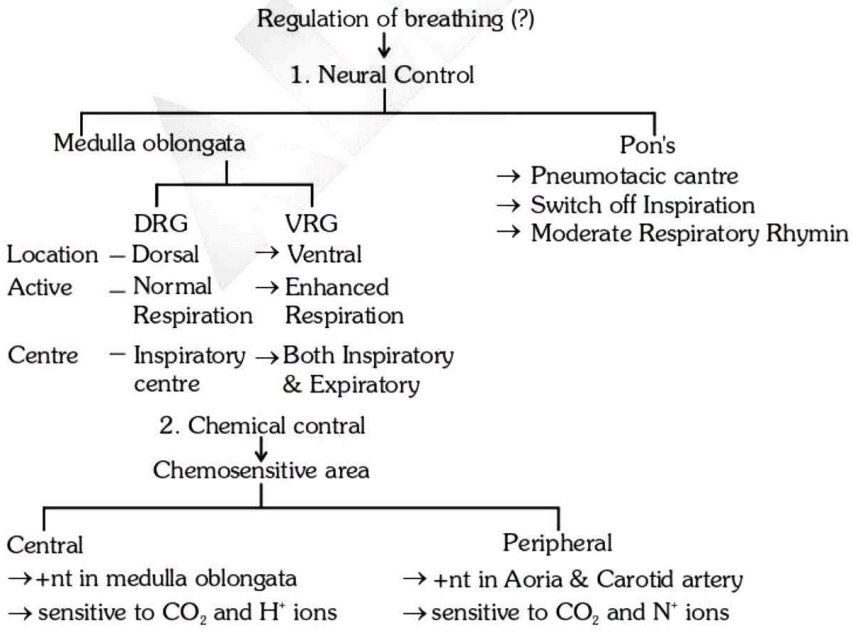
- Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure. Inspiration is initiated by the contraction of diaphragm and external inter costal muscles (EICM).

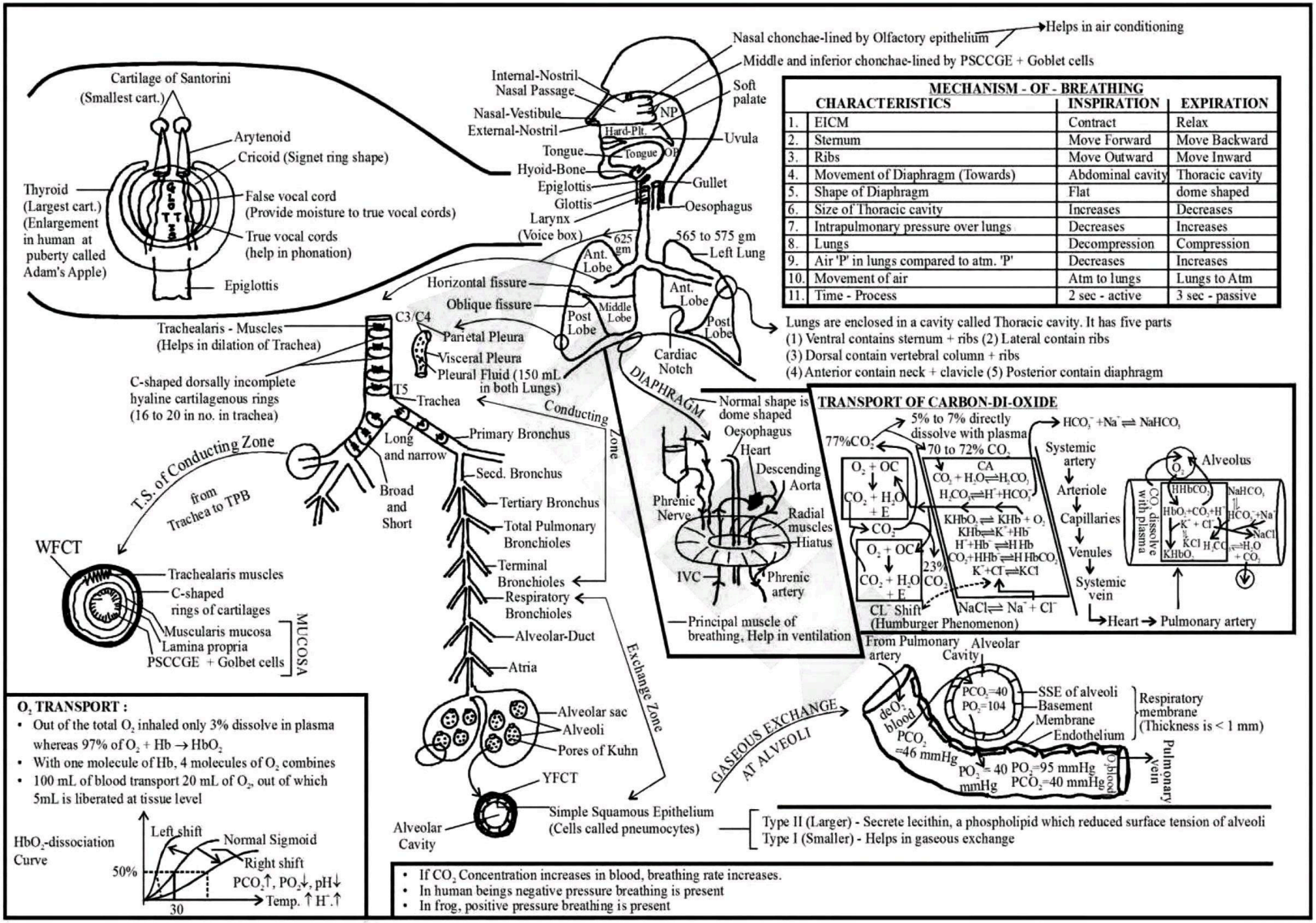
  Expiration takes place when the intrapulmonary pressure more than the atmospheric puressure. In this diaphragm and EICM are relaxed.
- Alveoli are the primary sites of exchange of gases. Exchange of gases also occur between blood and tissues. O_2 and CO_2 are exchanged in these sites by simple diffusion mainly based on pressure/concentration gradient.
- **Partial pressures (in mm Hg) of oxygen and carbon dioxide.**

Respiratory Gas	Atmospheric Air	Alveoli	Deoxygenated blood	Oxygenated blood	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

S.No.	Respiratory volumes and capacities	Value
1	Tidal volume (TV)	500 ml
2	Inspiratory reserve volume (IRV)	2500-3000 ml
3	Expiratory reserve volume (ERV)	1000-1100 ml
4	Residual volume (RV)	1100-1200 ml
5	Inspiratory capacity (TV + IRV)	3500 ml
6	Expiratory capacity (TV + ERV)	1600 ml
7	Functional residual capacity (ERV + RV)	2300 ml
8	Vital capacity (TV + IRV + ERV)	4600 ml
9	Total lung capacity (TV + IRV + ERV + RV)	5800 ml

- Blood transport O_2 in the form of oxyhaemoglobin. O_2 can bind with heamoglobin in a reversible manner to form oxyhaemoglobin. Each haemoglobin molecule can carry a maximum of four molecules of O_2. Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2.
- Oxygen dissociation curve is sigmoid.
- High PO_2 low PCO_2, lesser H^+ concentration and lower temperature, the factors are all favourable for the formation of oxyhaemoglobin.
- Every 100 ml of oxygenated blood can deliver around 5 ml of O_2 to the tissues.
- CO_2 is transporeted by blood in three forms :
  (i) Carbamino - haemoglobin (about 20-25%)
  (ii) Bicarbonate - (about 70%)
  (iii) Dissolved in plasma (about 7%)
- Every 100 ml of deoxygenated blood delivers approximately 4 ml of CO_2 to the alveoli.
- Respiratory rhythm centre present in the medulla region and pneumotaxic centre present in the pons region.
- Asthma is due to inflammation of bronchi and bronchioles.
- In Emphysema alveolar wall are damaged so respiratory surface is decreased.





MECHANISM - OF - BREATHING

	CHARACTERISTICS	INSPIRATION	EXPIRATION
1.	EICM	Contract	Relax
2.	Sternum	Move Forward	Move Backward
3.	Ribs	Move Outward	Move Inward
4.	Movement of Diaphragm (Towards)	Abdominal cavity	Thoracic cavity
5.	Shape of Diaphragm	Flat	dome shaped
6.	Size of Thoracic cavity	Increases	Decreases
7.	Intrapulmonary pressure over lungs	Decreases	Increases
8.	Lungs	Decompression	Compression
9.	Air 'P' in lungs compared to atm. 'P'	Decreases	Increases
10.	Movement of air	Atm to lungs	Lungs to Atm
11.	Time - Process	2 sec - active	3 sec - passive