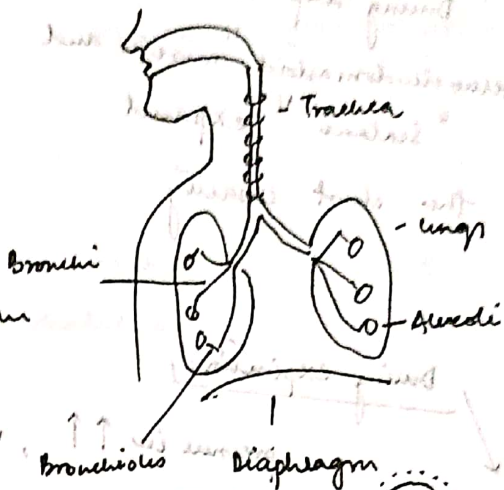
Human physiology

* Respiratory system

Gaseous exchange

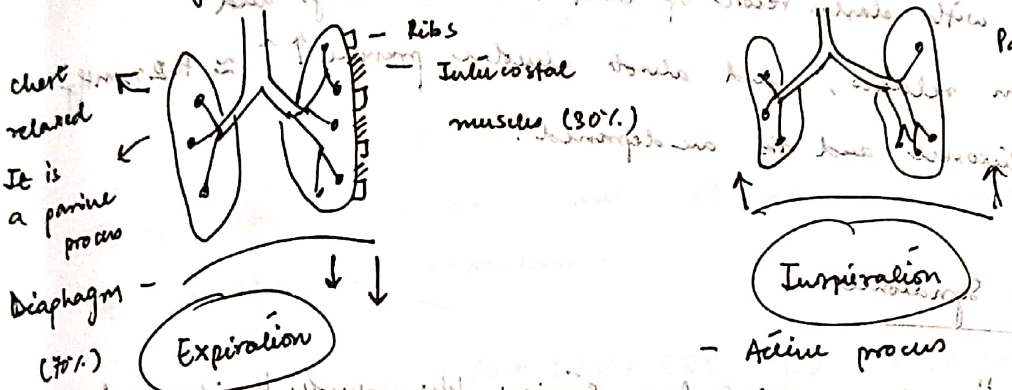
- upper respiratory ~~clear~~ system → Nose, pharynx → larynx – also voice box.

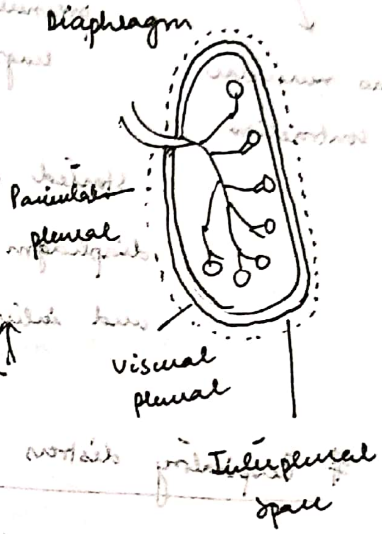
- lower respiratory system – trachea, bronchi, bronchioles, Diaphragm and intercostal muscles.



Mechanism of Breathing

Involuntary control by "Medulla oblongata"





Pressure changes during pulmonary ventilation

pressure before inhalation = 760 mmHg

from boyle's law,

$$\boxed{\downarrow\uparrow P \propto \frac{1}{V\downarrow\uparrow}}$$

To perform, inhalation the lungs should expand in order to inc.↑ vol. and pressure ↓. As, the process of diffusion (conc. gradient) air will flows from high pressure to lower pressure.

This also involves contraction of ~~diagram~~ diaphragm with upward movement of ribs to inc.↑ chest capacity.

(Intrapulmonic pressure) Alveolar pressure = < 760 mmHg

During deep Inhalation = <<< 760 mmHg

"Sternocleidomastoid" muscles and "Scalene" expand the chest capacity

Intrapleural pressure = 754 - 756 mmHg

During expiration,

no muscular contraction

pressure in lungs ↑↑ , volume ↓↓

started with elastic recoil of chest wall and lungs and diaphragm relaxes, and alsot alveolar pressure ↑↑ ≈ 762 mmHg and intercostal and ribs are depressed.

Respiratory distress Syndrome.

"Surfactant" reduces the surface tension b/w alveoli fluids and alveoli.

(mixture of phospholipids and lipoproteins)

- Deficiency of this in infants cause RDS due to ~~alveolar~~ alveolar collapse.

Respiratory capacities

Lung volumes : It is refers to as / different amounts of air a lungs can hold during as different phases of respiratory cycle in lungs.

1. Tidal volumes : Volumes of air inhaled or / exhaled in an normal breath
(500 ml)

2. Inspiratory reserve volume (IRV) : The amount of air that can be inhaled after forceful inhalation.
(3100ml) ~ 3000ml

3. Expiratory reserve volume (ERV) : The amt. of air that can be exhaled after forceful inhalation,
(1000ml) ~ 1100ml.

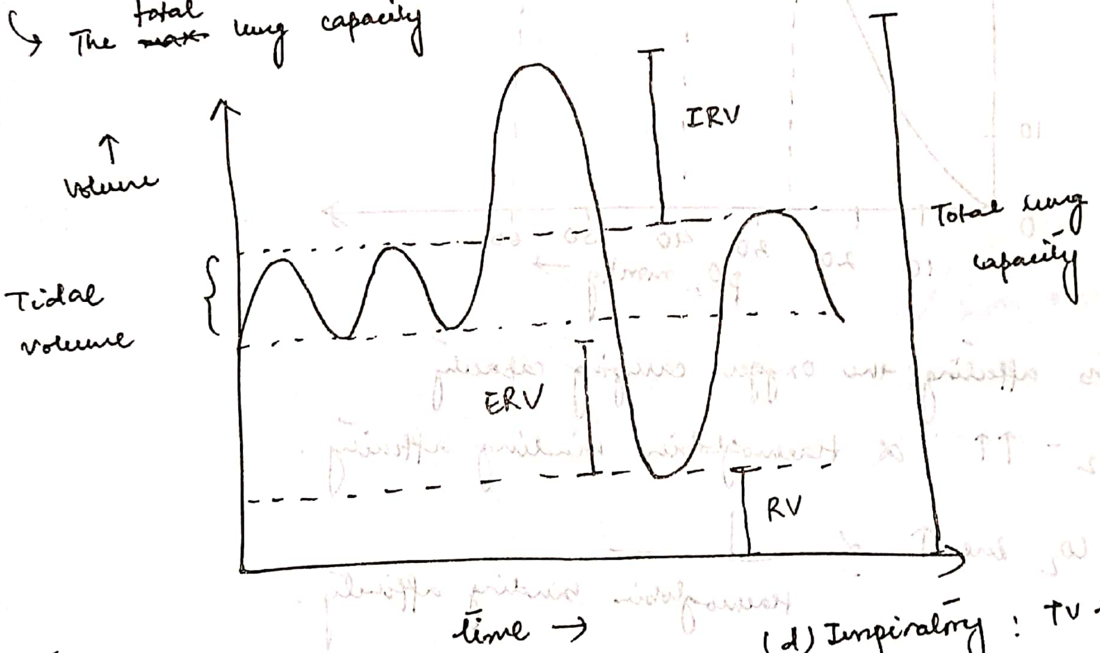
4. Residual volume (RV) : The volume of air remaining in the lungs after maximum exhalation.
(1200ml)

Lung capacity

(a) Vital capacity : TV + IRV + ERV
= 500 ml + 3000ml + 1100 ml
= 4600 ml.

It is refers to as max. amt. of air can a person can exhale after a maximum inhalation.

(b) Total lung capacity : TV + IRV + ERV + RV ⇒ 6000ml.
↳ The ~~max~~ total lung capacity



(c) functional residual capacity (FRV) : ERV + RV = 2400ml

(d) Inspiratory capacity (Ic) : TV + IRV ⇒ 3600 ml.

Mechanism of transport of oxygen

$\boxed{* \; 1 \; Hb = 4 \text{ molecule of } O_2}$

Blood (plasma) 1%.

combined with Hb - 99%

100ml blood → 0.3ml blood + 19.7ml blood

0.3ml blood ↓ plasma

19.7ml blood ↓ Hb

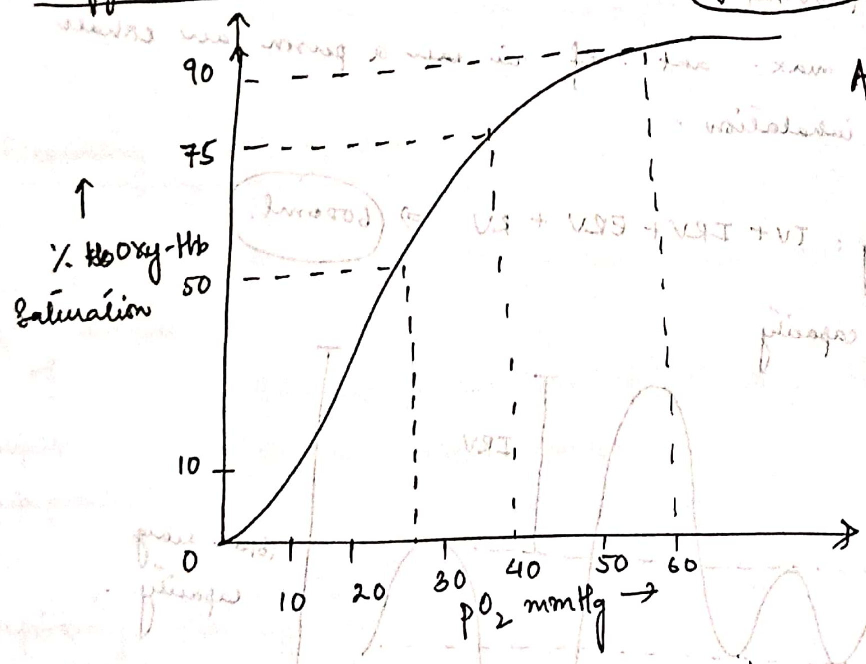
* $Hb + O_2 \rightleftharpoons Hb\text{-}O_2$

O_2 affinity to Hb depends on partial pressure O_2

$pO_2 \uparrow = \uparrow$ affinity

Oxygen-Hb dissociation curve

Sigmoid curve

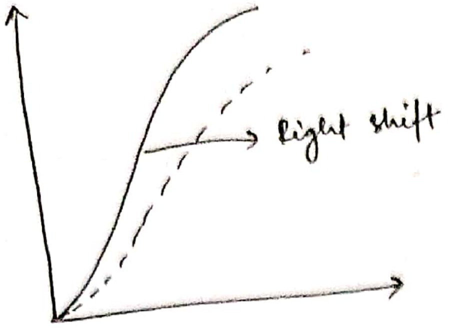


Around at 10 pO_2 mmHg ⇓ 10%

factors affecting the oxygen carrying capacity

1. pO_2 - ↑↑ ∝ Haemoglobin binding affinity.
2. CO_2 inc.↑ ∝ $\frac{1}{\text{Haemoglobin binding affinity}}$.
3. pH ↓ (acidic)
4. inc.↑ in temperature.

* Bohr's - haldane effect - in term of O_2 saturated curve



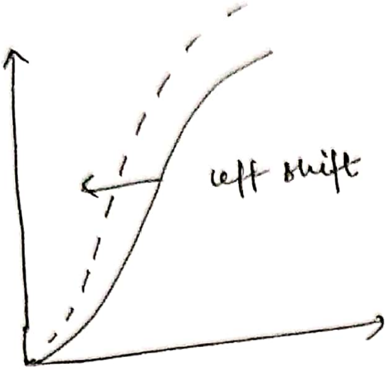
Conditions : $CO_2 \uparrow\uparrow$, $pH^+ \uparrow\uparrow$, in tissues

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

Bicarbonate

$\downarrow$ pH $\downarrow$

dec. $\downarrow$ of affinity for O_2



$CO_2 \downarrow$, pH $\uparrow$, Acidity $\downarrow$

~~Hb + H2CO2~~

$$R\text{-}NH_2 + CO_2 \rightleftharpoons R\text{-}NH\text{-}COO^{\ominus} + H^+$$

(carbamate)

enhance deoxy-hb stability.

Transport of transport of CO_2 in blood

- Dissolved 7%
- Carbamino 23%

$$Hb + CO_2 \rightleftharpoons HbCO_2$$

- Bicarbonate 70%

$$CO_2 + H_2O \overset{CA}{\rightleftharpoons} H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

* $pCO_2 \uparrow\uparrow \rightarrow HbCO_2 \uparrow\uparrow$