Physiology

Topic - Respiration

VI Semester B.Sc Zoology

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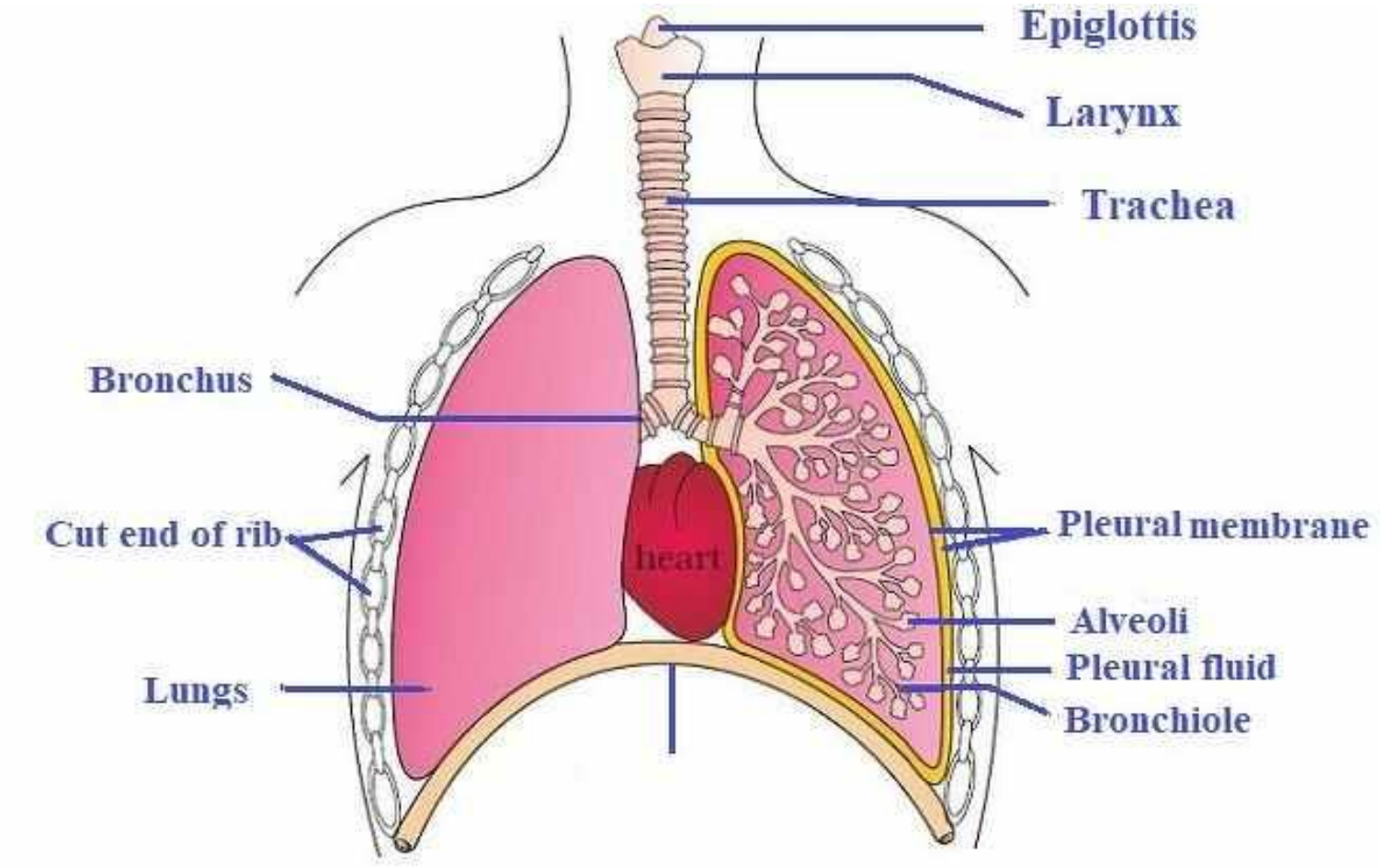
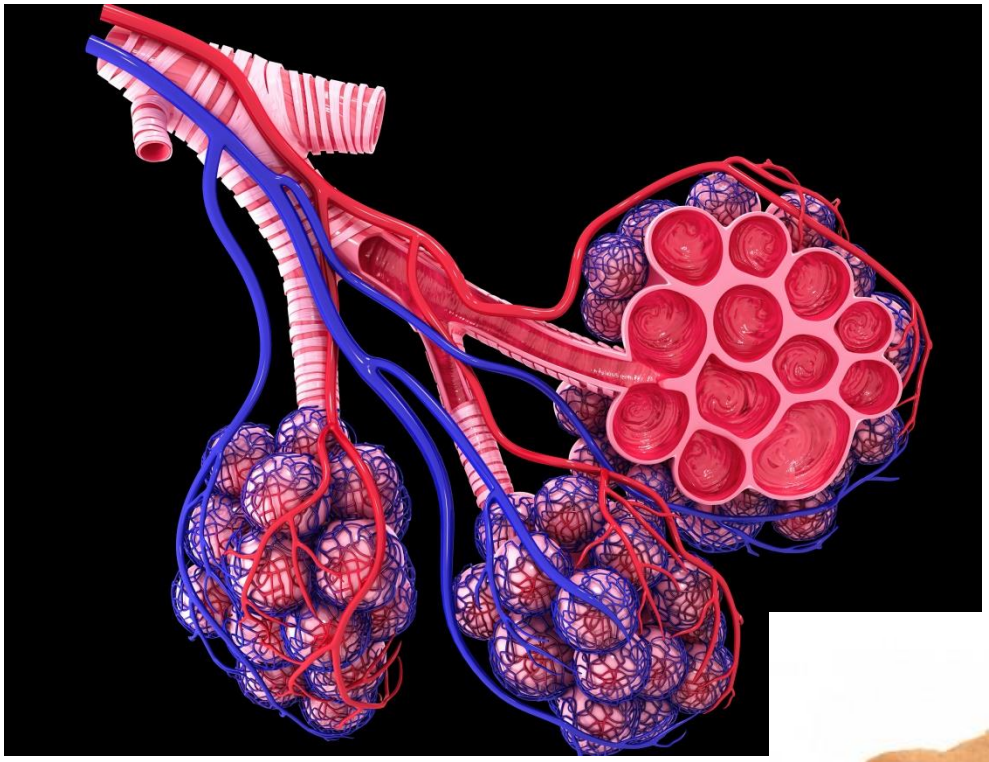
Respiration

Human respiratory system





Alveoli

Steps involved in respiration

- Breathing/pulmonary ventilation
- Diffusion of gases across alveolar membrane
- Transport of gases by blood
- Gas exchange at tissues
- Utilisation of oxygen by cells and resultant production of CO_2

Gas exchange at alveoli and tissues

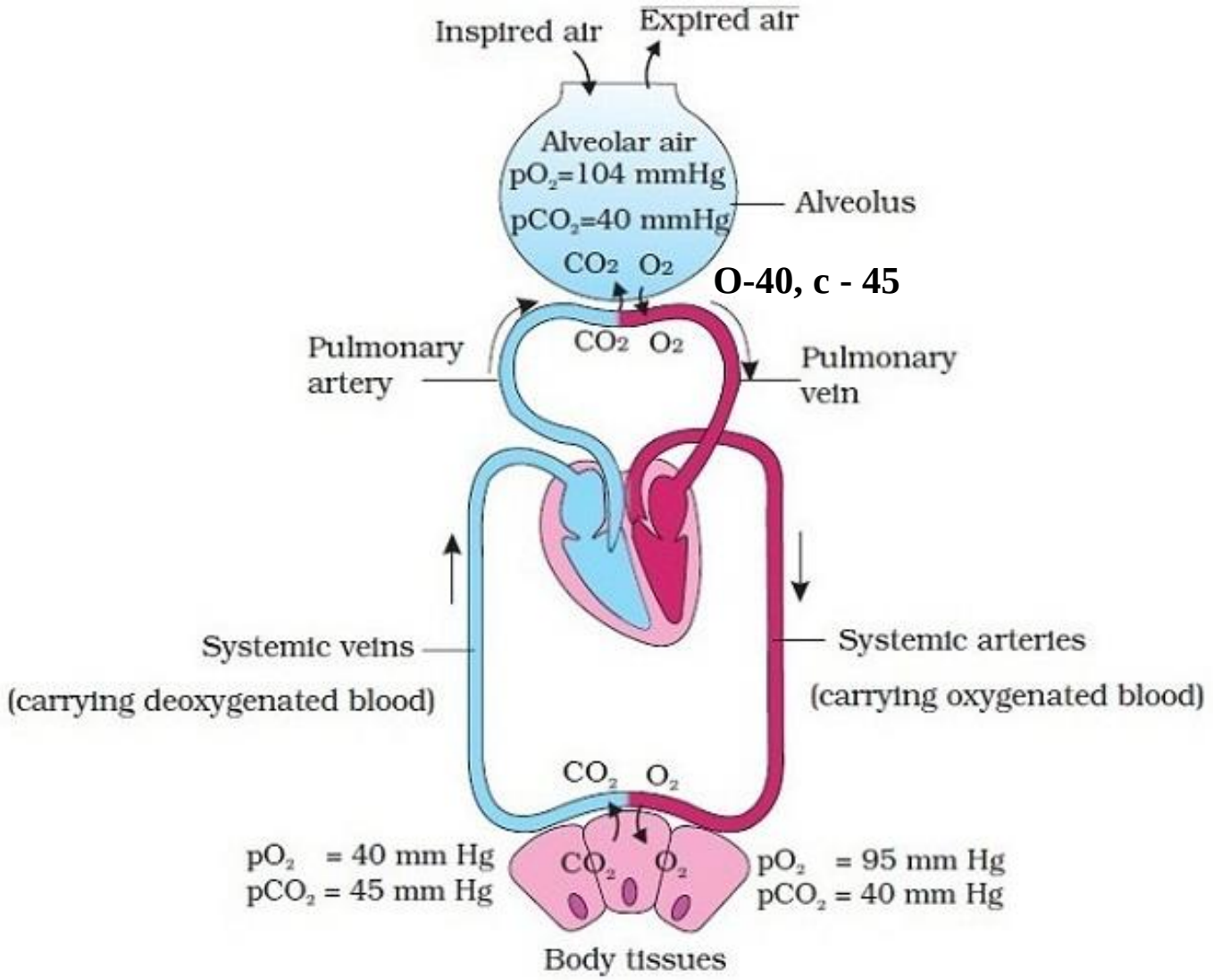
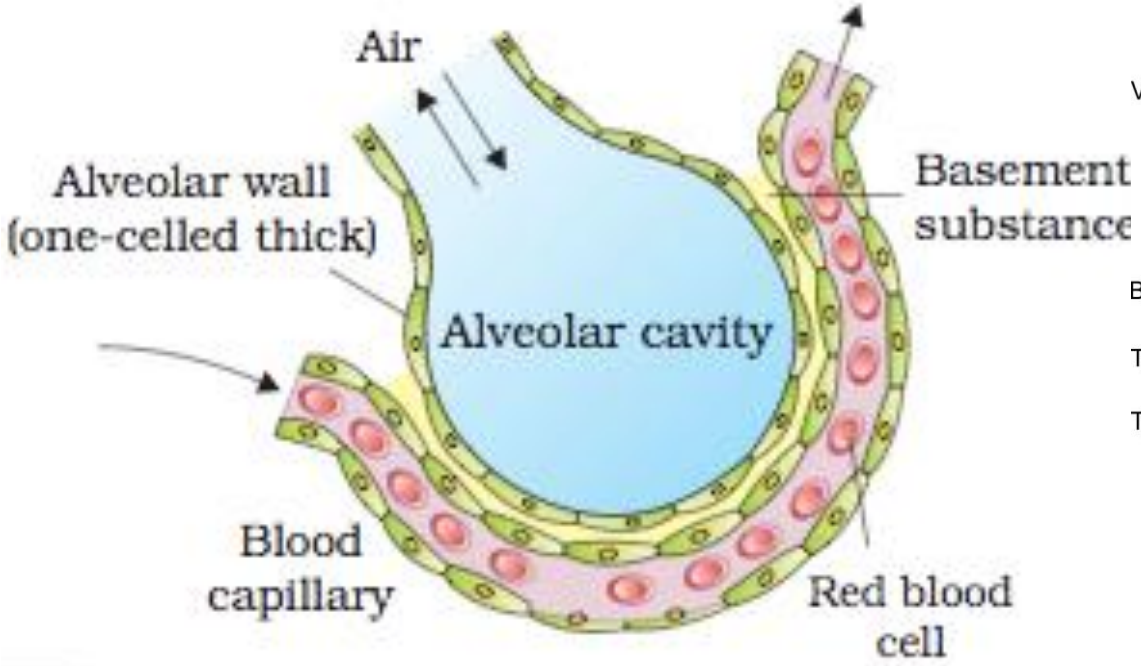
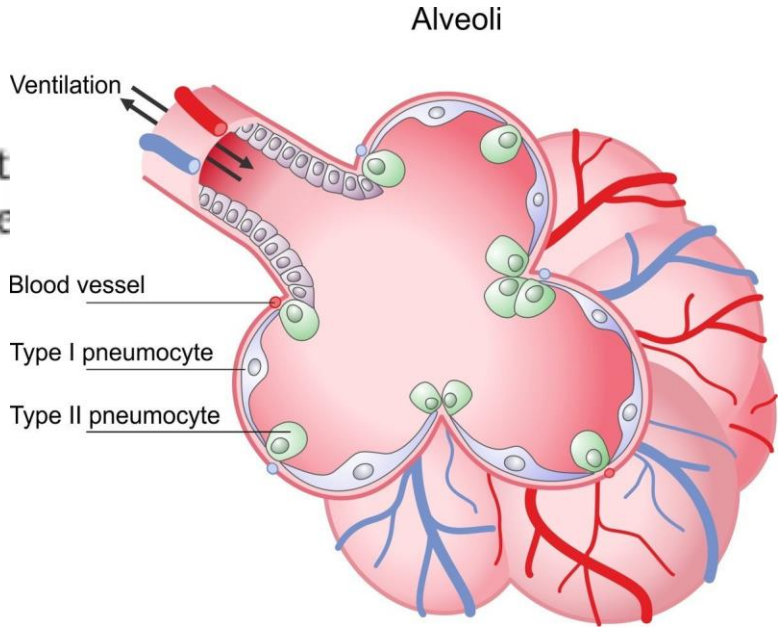


TABLE 17.1 Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

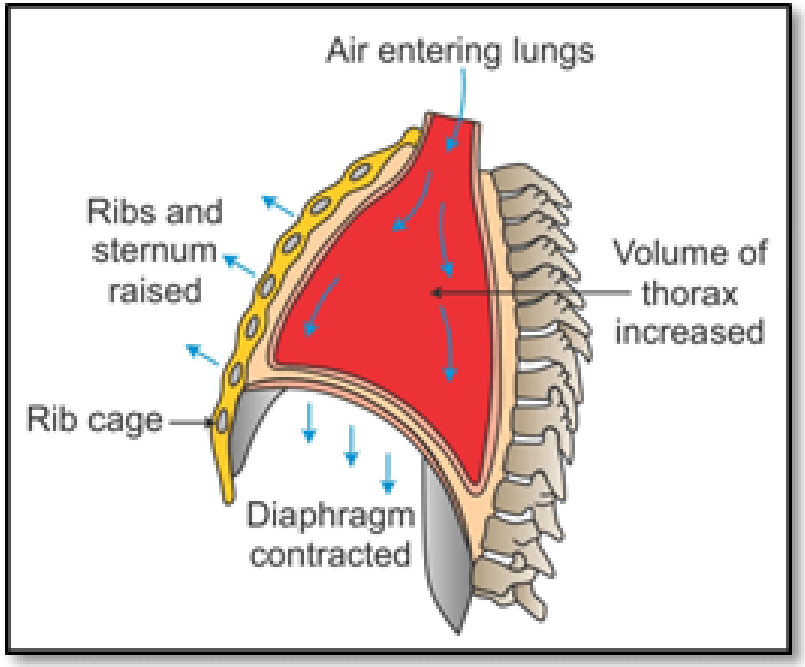
Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

Type I – Squamous, gas exchange
Type II – secrete surfactant protein

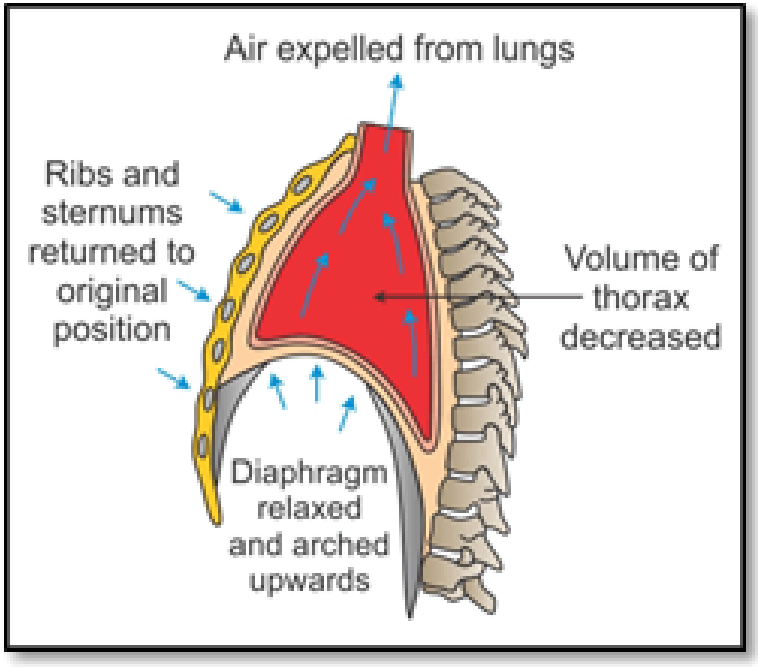




Mechanism of breathing



Inspiration



Expiration

Gas exchange

- By simple diffusion
- No energy expenditure
- Ventilation – movement of air/water across respiratory surface

Factors affecting gas exchange

- Pressure gradient
- Solubility coefficient of gases in liquid medium
- Diffusion coefficient and diffusion capacity
- Ventilation – perfusion ratio
- Temperature
- Thickness and surface area of respiratory membrane

Respiratory structures

- Lower forms – body surface
- Insects – tracheal tubes
- Aquatic organisms – gills
- Terrestrial mollusc – pulmonary sac
- Spiders – book lungs
- Limulus – book gills
- Fish - gills
- Amphibians – skin, buccal epithelium and lungs
- Reptiles, birds and mammals - lungs

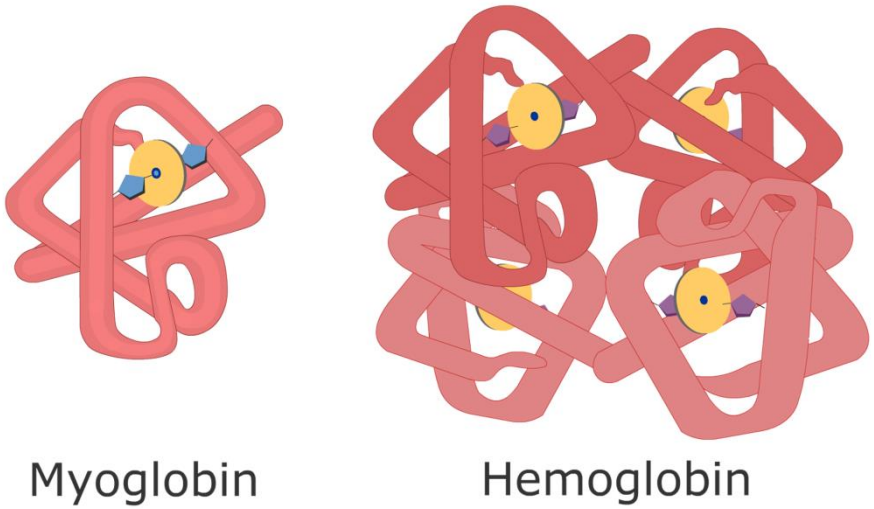
External respiration in aerobic animals

- Cutaneous (Annelids, amphibians, fishes like Anguilla, Periophthalmus etc.)
- Branchial (aquatic animals)
- Tracheal (insects, centipedes etc.)
- Pulmomary (book lungs, pulmonary sacs and lungs)

Respiratory pigments

- Complex, coloured and metal containing conjugated proteins
- Haemoglobin
- Myoglobin
- Haemocyanin
- Haemerythrin
- Chlorocruonin

Myoglobin

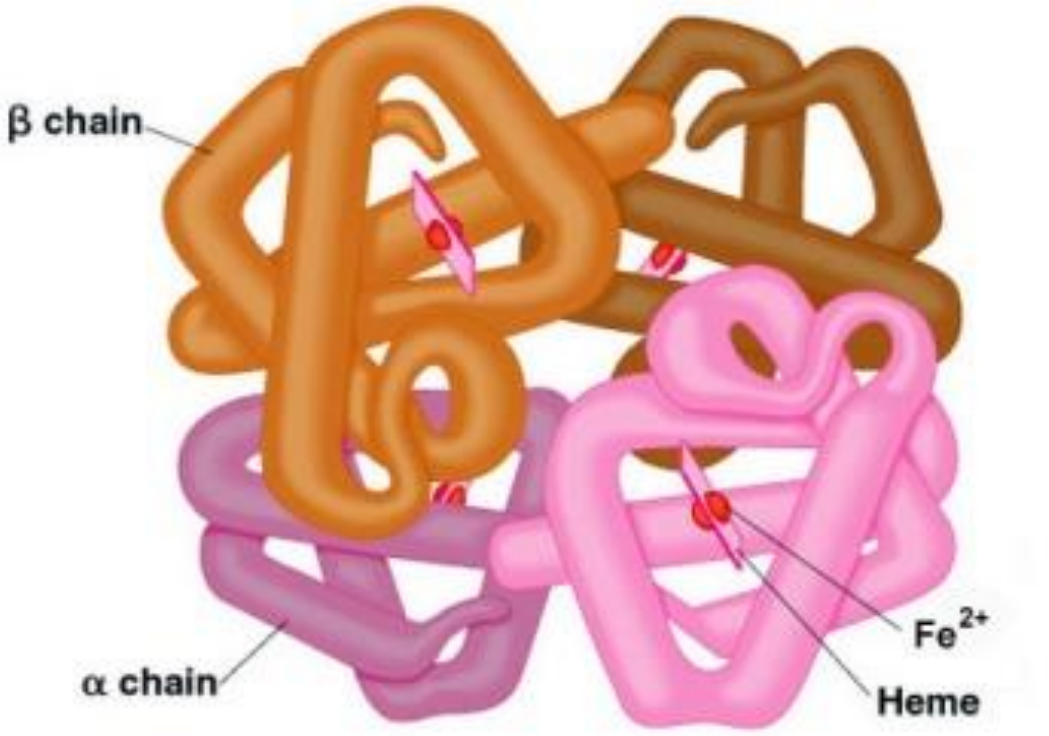


- Muscle Hb.
- Monomeric globular protein
- Intracellular storage of oxygen

Antarctic ice fish

Only vertebrate without respiratory pigments

Haemoglobin

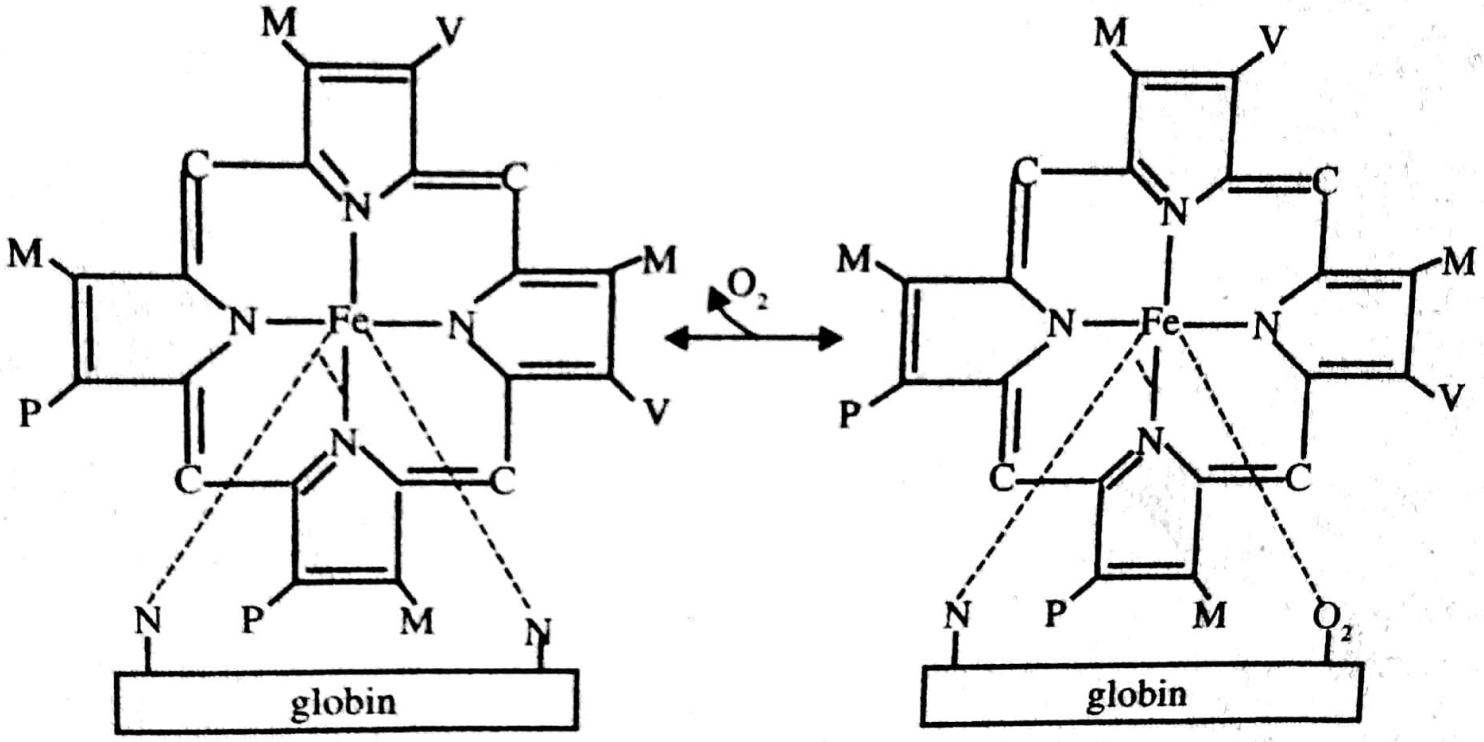


αchain -141 amino acid

βchain – 146 amino acid

HbA – 66,684 Daltons

Hb molecule



Haemoglobin molecule

M–methyl group (– CH_3). P–propionic group (– CH_2 – CH_2 – COOH)

V–venyl group (– CH = CH_2)

Transport of gases

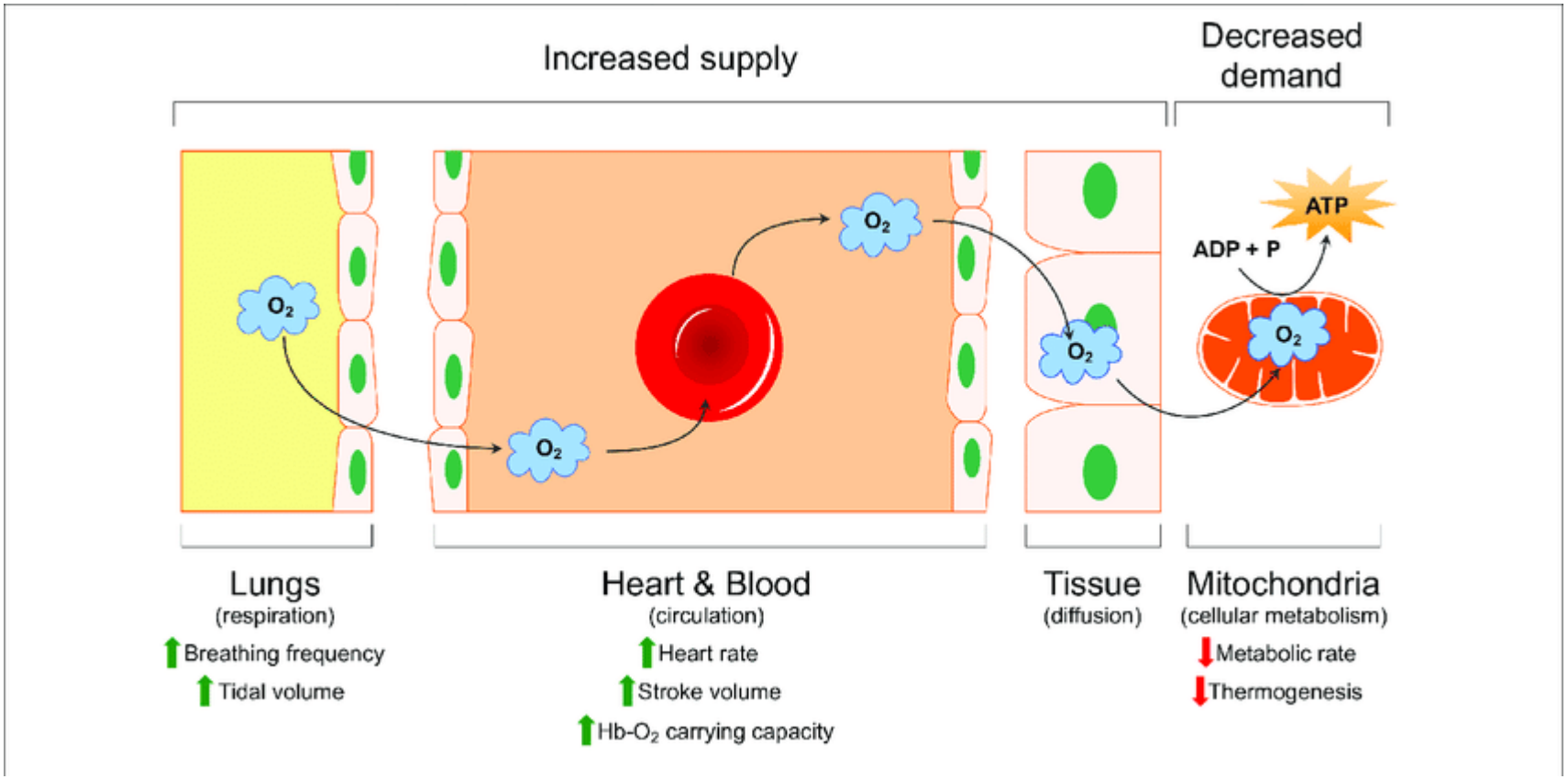
- Medium of transport – blood
- Oxygen : 97% as oxy Hb, 3% in dissolved form
- Carbon dioxide : 70% as bicarbonates, 20 – 25% as carb amino Hb, 7% in dissolved state

Transport of O_2

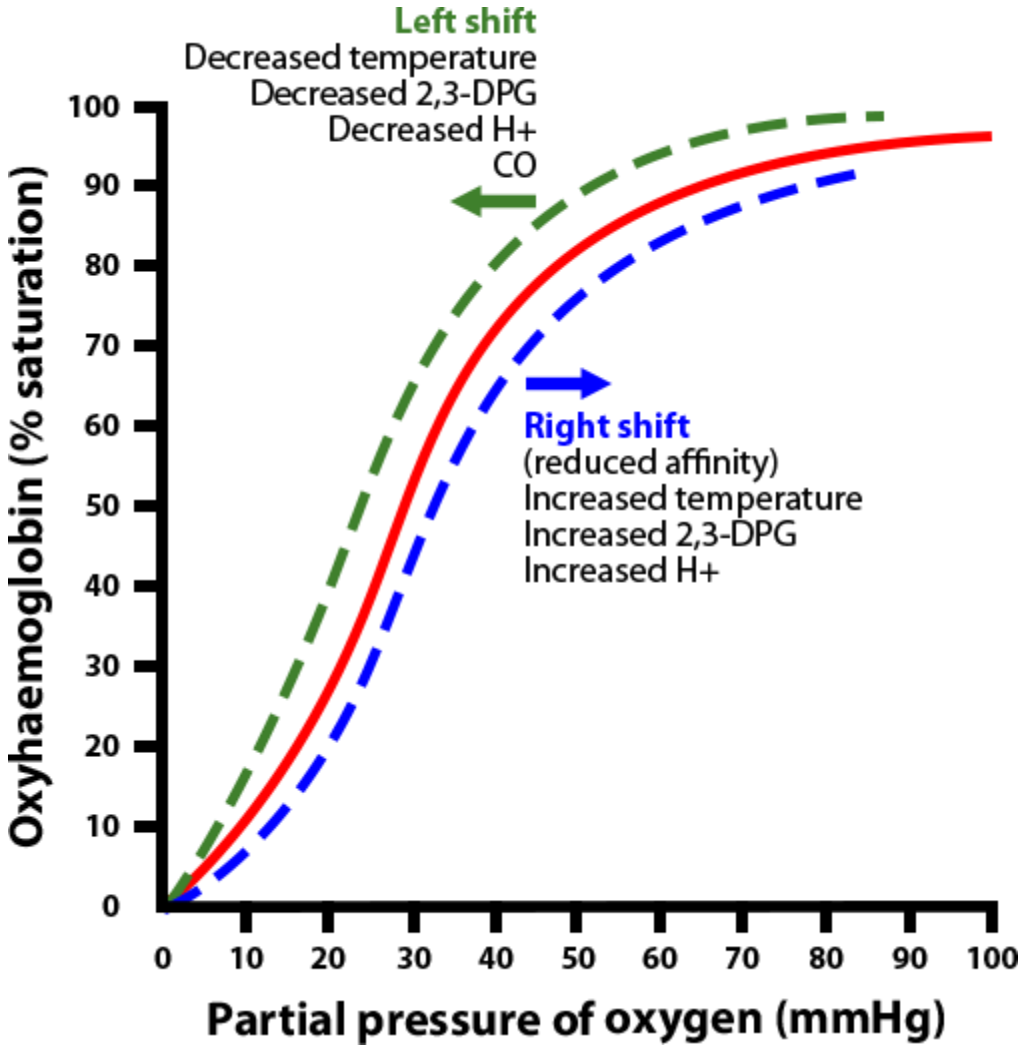
- Depends on solubility coefficient, pressure gradient and temperture

- 1 ml of blood can carry 0.003ml of oxygen

Transport of O_2 by Hb.



Oxygen dissociation curve



DIFFERENCES BETWEEN BOHR'S AND HALDANE'S EFFECT

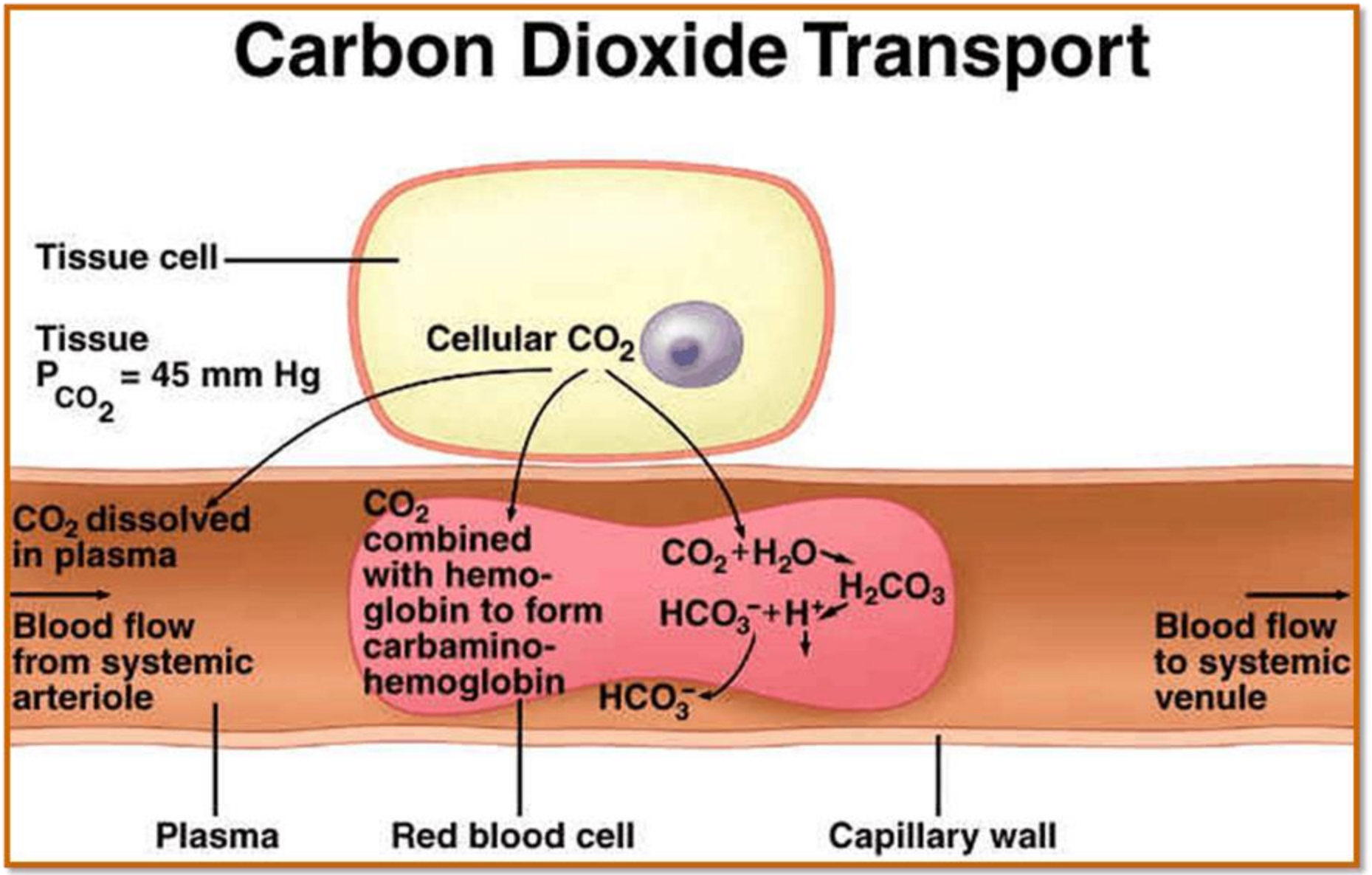
- ***BOHR'S EFFECT***

1. ***It is the effect by which the presence of CO2 decreases the affinity of Hb for O2***

- HALDANE EFFECT

1. It is the effect by which combination of O2 with Hb displaces CO2 from Hb

Carbon Dioxide Transport



Regulation of respiration

- Nervous (respiratory centre in brain) and chemical control (chemoreceptors)
- Respiratory centre : medullary rhythmicity centre in medulla, pneumotaxic area in pons and apneustic area in pons
- Chemoreceptors : central chemoreceptor (medulla) and peripheral chemoreceptors (in aortic and carotid arches