

Respiration During Exercise

O₂ Transport in the Blood

- O₂ is transported by haemoglobin – protein, contains iron, in all red blood cells
 - 4 O₂ molecules per haemoglobin
 - direction of reaction depends on: PO₂ of blood + affinity between Hb+O₂
 - the amount of O₂ that can be transported per blood unit depends on the concentration of haemoglobin
 - O₂ + haemoglobin = 'loading' → oxyhaemoglobin
 - release of O₂ from haemoglobin = 'unloading' → deoxyhaemoglobin

Oxyhaemoglobin Dissociation Curve (sigmoidal curve)

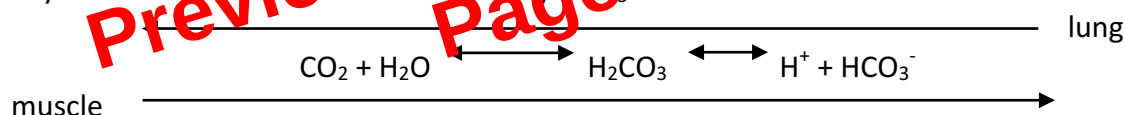
At lungs: high PO₂ = formation of oxyhaemoglobin

At tissues: low PO₂ = release of O₂ to tissues

- Effect of pH
 - decreased pH lowers Hb-O₂ affinity
 - "right" shift ← Bohr effect (H⁺ binds to haemoglobin)
 - favours offloading of O₂ to tissues
- Effect of Temperature
 - increased blood temperature lowers Hb-O₂ affinity
 - "right shift" – O₂ offloading
- Effect of 2-3 DPG
 - by-product of red blood cell glycolysis
 - "right" shift during altitude exposure

Ventilation & Acid-Base Balance

changes in pH due to pCO₂ changes
Pulmonary ventilation removes H⁺ from blood by HCO₃⁻ reaction:



- INCREASED ventilation = CO₂ exhalation; reduced PCO₂ & H⁺ concentration
- DECREASED ventilation = CO₂ build-up; increased PCO₂ & H⁺ concentration

O₂ Transport in the Muscle

Myoglobin shuttles O₂ from cell membrane to mitochondria.

- Large quantities in slow-twitch fibres
- Small quantities in intermediate fibres
- Limited quantities in fast-twitch fibres

*Higher O₂ affinity than haemoglobin
(event at low PO₂)
- Allows Mb to store O₂ = reserve*

Which is important as at the start of exercise there's a time lag between onset of muscle contraction & increased O₂ delivery so reserves buffer the muscle O₂ needs (at start) – this contributes to O₂ debt.

CO₂ Transport in the Blood

At tissue: H ⁺ binds to Hb HCO ₃ ⁻ diffuses out of RBC into plasma Cl ⁻ diffuses into RBC = chloride shift	At lung: O ₂ binds to Hb reaction reverses to release CO ₂
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