Oxygen Dissociation Curves:

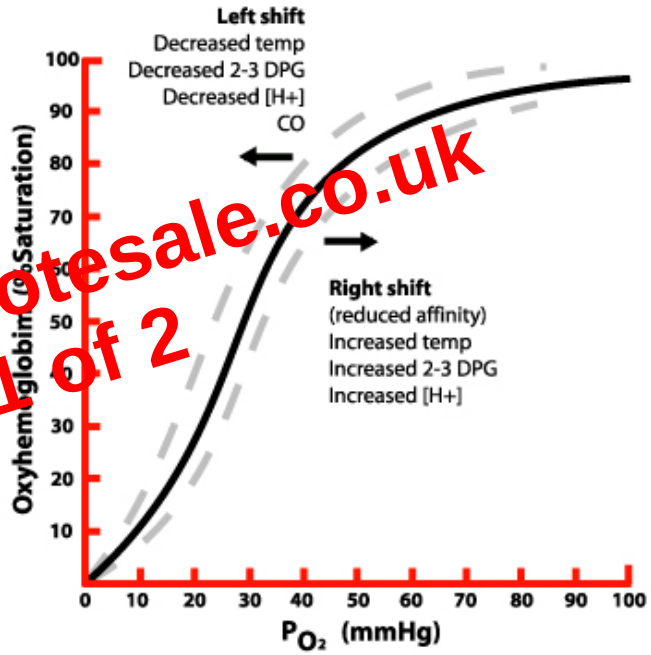
When haemoglobin is exposed to different partial pressures of oxygen, it doesn't bind to oxygen evenly. **The oxygen dissociation curve shows the relationship between the saturation of haemoglobin with oxygen and the partial pressure of oxygen.**

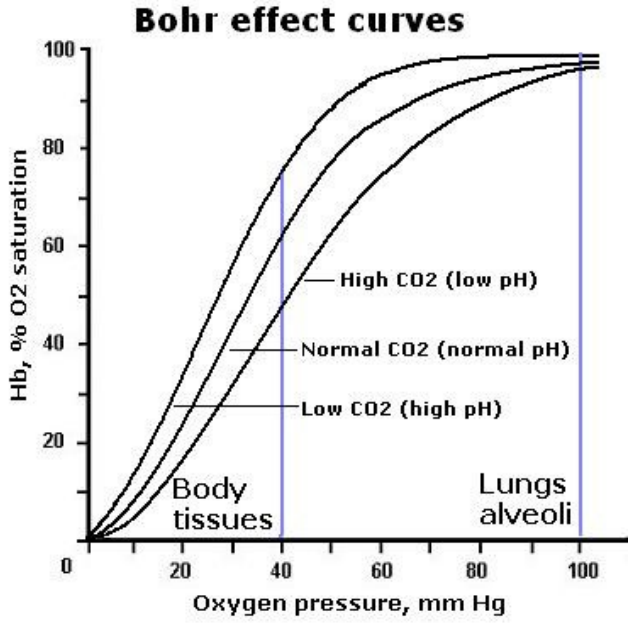
- The **shape of the haemoglobin molecule makes it difficult for the first oxygen molecule to bind to one of its four polypeptides subunits because they are closely united**. At **low oxygen concentrations, little oxygen binds to haemoglobin.**
- The binding of this first oxygen molecule **changes the quaternary structure of the haemoglobin molecule**, causing it to change shape. **This change makes it easier for the other subunits to bind to an oxygen molecule.**
- It therefore **takes a smaller increase in the partial pressure of oxygen to bind the second oxygen molecule than it did to bind the first one. This is known as positive cooperativity because binding of the first molecule makes binding of the second easier and so on**. The gradient of the curve steepens.
- After the binding of the third molecule, **its harder to bind a fourth oxygen molecule.** This is all to do with probability, **with the majority of the binding sites occupied, its less likely that a single oxygen molecule will find an empty site to bind to. The gradient of the curve reduces and the graph flattens off.**

The further to the left of the curve, the greater is the affinity of haemoglobin for oxygen.

The further to the right of the curve, the lower is the affinity of haemoglobin for oxygen.

Transport of oxygen by haemoglobin





Effects of CO2 Concentration:

Haemoglobin has a reduced affinity for oxygen in the presence of carbon dioxide. The greater the concentration of CO2, the more readily the haemoglobin releases its oxygen (the Bohr effect).

- At the gas exchange surface (lungs) the concentration of CO2 is low because it **diffuses across the exchange surface and is excreted by the organism**. The affinity for oxygen (by haemoglobin) is increased, which coupled with the high concentration of oxygen in the lungs means that oxygen is readily loaded by haemoglobin. **The reduced CO2 concentration has shifted the oxygen dissociation curve to the left.**
- In **rapidly respiring tissues (eg muscles) the concentration of CO2 is high**. The affinity of haemoglobin for oxygen is reduced, which coupled with the low concentration of oxygen in the muscles, means that oxygen is readily unloaded from the haemoglobin into the muscle cells. **The increased CO2 concentration has shifted the oxygen dissociation curve to the right.**

The greater the concentration of CO2, the more readily haemoglobin releases its oxygen. This is because dissolved CO2 is acidic and the low pH causes haemoglobin to change shape.