

Haemoglobin and Myoglobin

- Haemoglobin is one of 2 **oxygen-binding proteins** found in all vertebrates
 - The function of this protein is to carry oxygen from the lungs to other tissues in the body and deposits it with **myoglobin**, the other oxygen-binding protein
 - **Haemoglobin is found within the erythrocytes** (red blood cells)
 - In mammals, haemoglobin makes up **96% of the dry weight of an erythrocyte**
 - This suggests that a red blood cell is nothing more than a sack for carrying haemoglobin as mature erythrocytes do not have any internal organelles
 - Haemoglobin has an oxygen-binding capacity of **1.34 mL O₂ per gram** and can **carry 4 oxygen molecules per haemoglobin molecule**
 - Haemoglobin has a complex quaternary structure:
 - The protein is made up of **4 separate polypeptide chains**
 - The 3D structure was found using **x-ray crystallography**
 - **83% of the amino acids in these chains differ from myoglobin, despite their structural similarities**
 - The most common form of haemoglobin is made of 2 chains:
 - An **α -chain** consisting of **141 amino acids**
 - A **β -chain** consisting of **146 amino acids**
 - Each subunit has a **prosthetic haem group**
 - Each chain also held together by **multiple non-covalent interactions**
 - Haemoglobin is an **allosteric protein**, meaning that the **binding of oxygen to one subgroup, affects the structure of other subgroups**
 - The binding of **one oxygen increases the affinity for the other 3**, thus making it easier to bond
 - **The binding of oxygen to haemoglobin is affected by the concentration of H⁺ ions and CO₂.** In **metabolically active tissue** the concentrations of these are **very high** and so, shift the dissociation curve to the right, making it easier for oxygen to release. This is known as the **Bor effect**.
 - This occurs because there are **H⁺ binding sites on the molecule that have a higher affinity for binding H⁺ in deoxyhaemoglobin than oxyhaemoglobin**
- Myoglobin, the other oxygen-binding protein is **very abundant in tissue where much aerobic respiration takes place**, such as **skeletal muscle tissue and cardiac tissue**
 - It consists of only one polypeptide chain of **153 amino acids**
 - It is very small and only has a **molecular mass of 17.8 kDa**
 - Its secondary structure is virtually only **alpha helices**
 - This protein also contains a **prosthetic haem group**, just like haemoglobin
- Below is a comparison of haemoglobin to myoglobin and of a comparison of their disassociation:

