

Myoglobin: An Oxygen Warehouse

Primary Author: Miriam Peters

Teammates: Alex Bluestein, Vanessa Bradfish, Sydney Freiberg, Liane Kee, Makenna Krueger, Gavin Lloyd, Grace Martin, Rachel Mallum, Peyton Molling, Skyler Moye, Megan Ninnemann, Varick Peak, Tim Plevak

Mentor: Dr. Diane Munzenmaier, Center for Biomolecular Modeling MSOE

Advisor: Mr. Bill Heeren

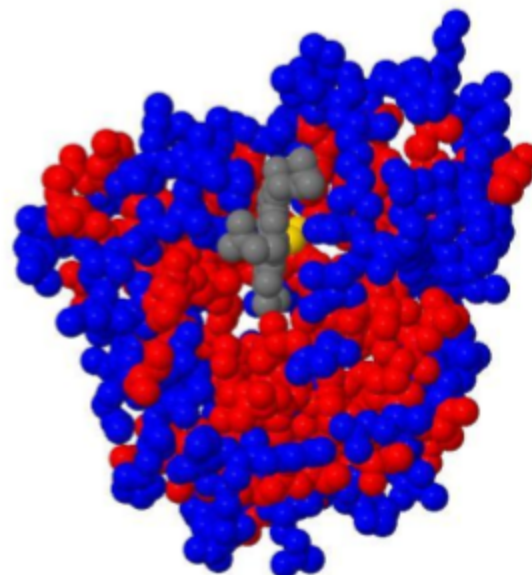
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Myoglobin is a protein similar to hemoglobin in that it binds iron and oxygen together. Myoglobin is found in the muscle and its primary purpose is to store oxygen. Myoglobin was the first protein to have a 3D structure using X-ray crystallography. Myoglobin, like all other globins, has a hydrophilic exterior and a hydrophobic interior. This is represented in the above diagram showing the blue polar residues that are attracted to water on the outside, and the red nonpolar water repelling residues on the inside of the globin. Myoglobin structure includes a pocket or groove where the heme group resides.

A heme group consists of a porphyrin cofactor and an iron (ferrous) ion. It is the non-protein part of the globins. The heme group allows for the oxygen to bind to the cofactor and attach itself to the globin. The heme group and corresponding heme pocket is conserved between the globins. Myoglobin is a monomer and thus can only have one oxygen molecule bonded to its heme group. Hemoglobin is a tetramer with four different globins present. Hemoglobin can bind to four oxygen molecules since it possess four different heme groups.

It is important to be able to differentiate between myoglobin and hemoglobin. Myoglobin's main purpose is to store oxygen in the muscles and to make the oxygen available during times of high oxygen demand. Myoglobin is not usually found in the bloodstream directly unless there is a muscle injury. In contrast, the primary function of hemoglobin is to transport oxygen through your blood specifically in red blood cells by catching and releasing the oxygen. Myoglobin monomer structure hangs onto oxygen tightly, whereas hemoglobin's tetramer structure allows for movement controlled by various allosteric factors such as pH, carbon dioxide levels and the presence of 2,3, bisphosphoglyceric acid.



Oxygenated Myoglobin
(PDB 1MBO)
Polar residues- Blue
Nonpolar residues- Red
Heme group- Gray
Oxygen molecule- Gold