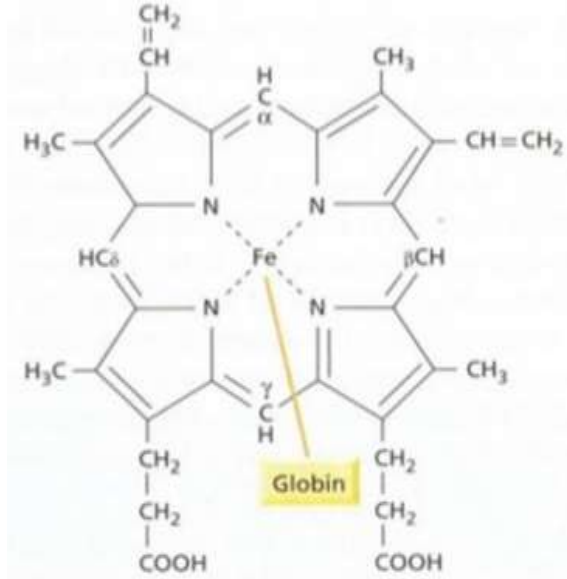


Chemistry in Day to Day Life

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Hemoglobin

Hemoglobin (Hb) is a major Hemoprotein of Human body. Hemoglobin chemically is a conjugated Protein.



In Hemoglobin, Heme is a Prosthetic group, Globin is a Protein part (Hemoglobin = Heme + Globin). Hemoglobin(Hb) is Red color pigment. Location of Hemoglobin Inside Red blood cells/Erythrocytes of blood.

- **Structure of hemoglobin**
- Iron containing pigment heme is attached to protein globin
- Heme is iron porphyrin complex called Iron protoporphyrin IX, Globin is a protein,

Forms of Hemoglobin

Hemoglobin exists in 2 forms, the taut form (T) and the relaxed form (R). This structural change to the taut form leads to low-affinity hemoglobin, whereas the relaxed form leads to a high-affinity form of hemoglobin with respect to oxygen binding.

Iron in Heme : Functional form Iron in Heme is-

- Ferrous form (Fe^{++}) Reduced state
- Fe^{++} located centrally in Protoporphyrin ring system.
- •Fe of Heme is Hexavalent
- 4 bonds linked with each Nitrogen of 4 Pyrrole rings. • 5 th bond linked with Proximal Histidine (F8) of Globin chain • 6 th bond is with Oxygen.
- Fe^{++} of Heme is linked to Proximal Histidine (F8)
- O_2 is linked to Distal Histidine(E7).
- Thus to attain stability Oxygen is bound to both Heme and Globin.

Functions of Hemoglobin

- Hemoglobin has important role in Respiration mechanism- Hb Majorly Transports Oxygen (97% -100%). Hb Minorly Transports – Carbon dioxide (15% -25%). Deoxy Hemoglobin Transports-Protons(H^+) • Oxygen transported by Hb and reached to every cell is used up in Mitochondrial ETC (Respiratory Chain/Cellular respiration)
- To generate ATP (Oxidative Phosphorylation)
- Hemoglobin Plays Role as Buffer- • ($Hb/Hb-H^+$) in the Erythrocytes, Resists change in pH
- Imidazole group of amino acid Histidine of Hb molecule, • Participates in buffering mechanism of Hb.

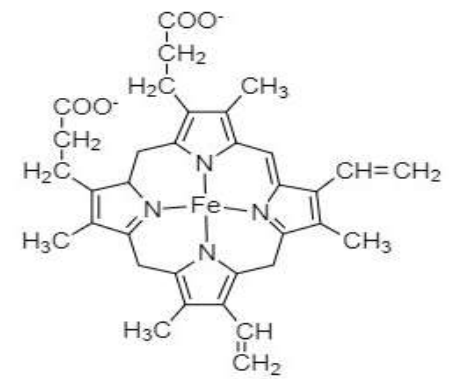
Digestion Process.

- **Digestion**- mechanical and chemical reduction of ingested nutrients which can be then converted to energy for use.
- **Human digestive system**- consists of the long alimentary canal that includes mouth, pharynx, oesophagus, stomach, small intestine, large intestine, rectum and anus.
- **Organs for assistance**- pancreas, liver
- **Saliva** is secreted by salivary glands located under the tongue which contains digestive enzymes like salivary amylase, which break down starch into sugar. So, digestion of carbohydrates starts in the mouth itself.

- **Tongue** helps in chewing, moistening, rolling and swallowing of food.
- The food from mouth then goes down the **oesophagus**, which is the food pipe to the stomach, through the movement of walls of oesophagus (peristalsis)
- **Stomach** mixes the food hence received with various digestive juices.
- • **Inner lining of stomach secretes:**
 - Mucus – protects the lining of stomach from being corroded by the acid
 - Hydrochloric acid – creates an acidic medium and dissolves bits of food.

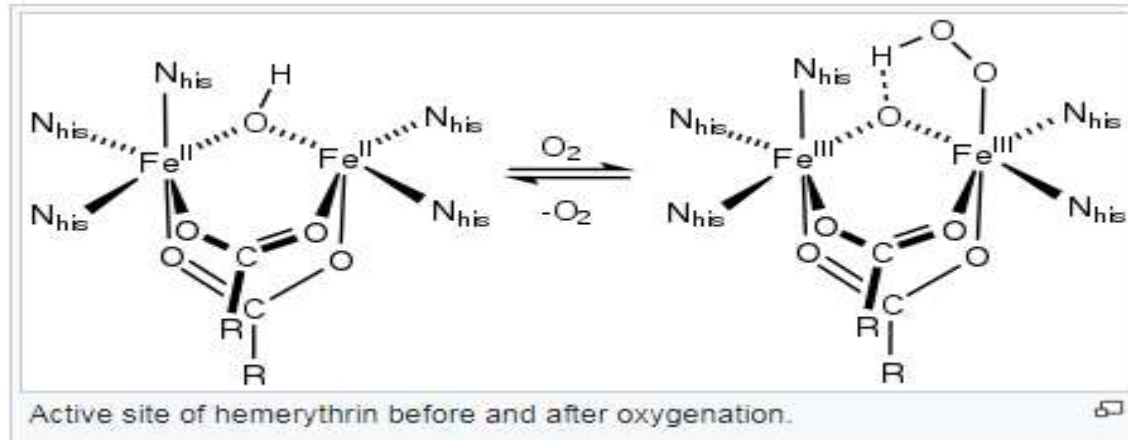
- Digestive juices – break down protein into simpler substances.
 - The food from stomach eventually moves into the small intestine.
 - **Digestion in small intestine:** It is the longest part (about 7.5 m long) of alimentary canal. It is the site where complete digestion of carbohydrates, proteins, and fats takes place. It gets intestinal juices from two different glands – liver and pancreas that help in the further digestion of food.
 - **Liver** is the largest gland of the body and secretes bile juice. **Bile juice** is stored in the gall bladder and has a significant role in the digestion of fats.
- Pancreas** has enzymes that help in total digestion of all food components.
- The digestive tract and associated glands together constitute the digestive system.

Myoglobin



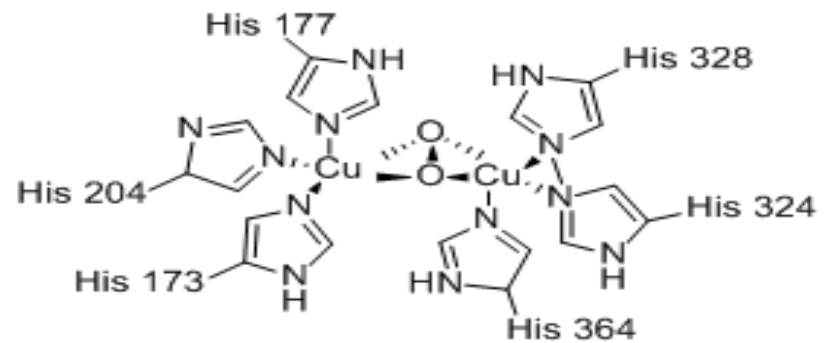
- Myoglobin can be abbreviated as (Mb) is
- a globular protein that has one prosthetic heme-group that binds with iron and oxygen. It is usually found in the cardiac and skeletal muscles but only produced at the time of muscle injury. It has a similar structure and function as that of hemoglobin.
- Myoglobin has a small monomeric structure of polypeptide that has 153 amino acid residues and a heme group that is bonded to the histidine group in the hydrophobic cavity of the globular protein. It basically has a porphyrin ring with a heme-group (Fe ion) in the center and has 8 alpha-helix loops connected via oxygen binding. The structure of myoglobin is given below:

Hemerythrin



- is a non-heme iron protein used by two phyla of marine invertebrates (sipunculids and brachiopods) for oxygen transfer and/or storage.
- It differs from the other oxygen-binding proteins (hemoglobin and hemocyanin) both in the polypeptide chain and in the metal complex used to reversibly bind dioxygen.
- Hemerythrin is a reversible oxygen binding metalloprotein found in blood cells of a few marine invertebrates. It is colorless in the deoxy form and on oxygenation the color changes to purple-red.

Hemocyanins



- Hemocyanins are copper containing dioxygen transport proteins present in molluscs and arthropods. Hemocyanins carry dioxygen as O₂.
- Hemocyanins (or haemocyanins) are oxygen carrying proteins/oxygen carriers in invertebrates such as molluscs (eg octopus, snails, and squids) and arthropods (eg scorpions, crabs, lobsters etc). It is extracellular protein and is present in hemolymph.