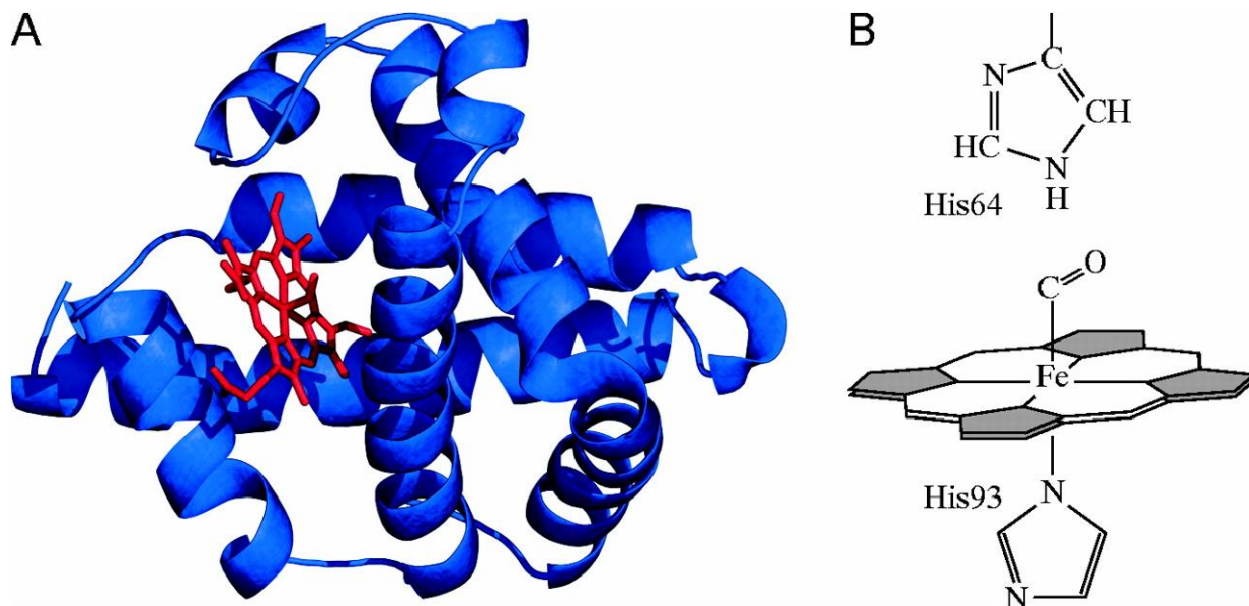


1. In hemoglobin (Hb) and myoglobin (Mb), the dioxygen-binding site is an iron-porphyrin complex in which the iron undergoes an oxidation from ferrous to ferric upon binding of dioxygen ( $O_2$ ). Carbon monoxide poisoning is caused when CO competes with oxygen for the binding site on the iron-porphyrin complex. In free iron-porphyrin complexes (without the protein) bind to CO 25000x's stronger than  $O_2$  but in hemoglobin and myoglobin CO only binds 200x's stronger than  $O_2$ . Explain the difference in binding of CO between the free iron-porphyrin complex and the iron-porphyrin complex contained in the proteins hemoglobin and myoglobin. (10 pts)



In hemoglobin and myoglobin, the iron-porphyrin binding site for  $O_2$  and CO is embedded within a binding pocket of the protein (A). CO and  $O_2$  will bind at the 6<sup>th</sup> coordination site of iron in a bent geometry due to the location of the distal histidine (B). CO is a linear molecule which prefers to bind in a linear fashion but the presence of the distal histidine causes the CO to bind in a bent geometry thus lowering the binding strength as compared to the iron-porphyrin complex without the protein and distal histidine.  $O_2$  is a bent molecule thus the effects of the distal histidine are not as great as those seen when CO binds.