



Myoglobin

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9/26/11





This lecture

- Myoglobin Background
 - What does it do?
- Myoglobin Structure
 - Lots of helices
- Myoglobin Function
 - Oxygen binding



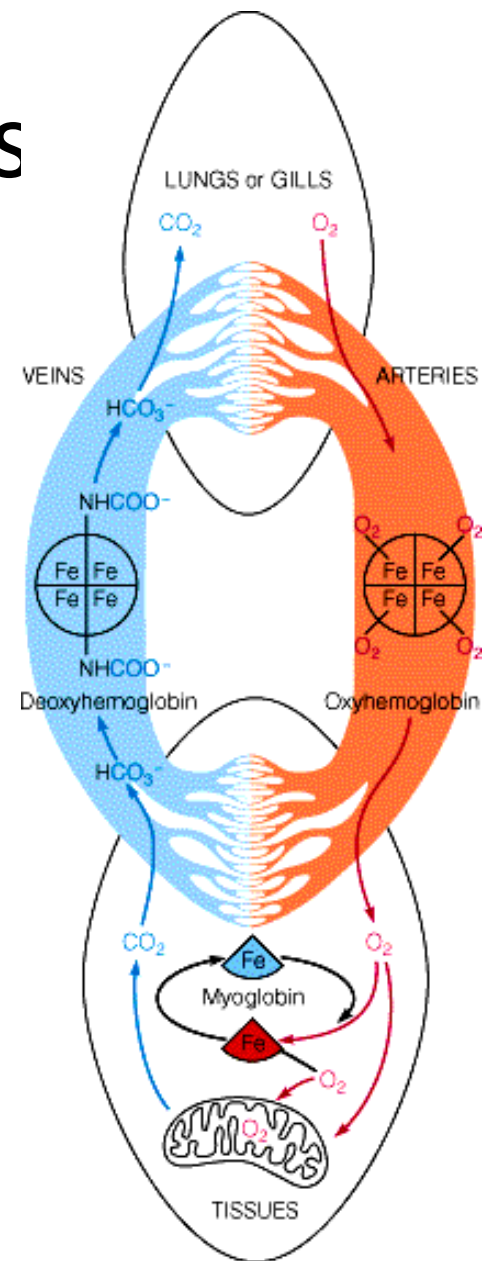
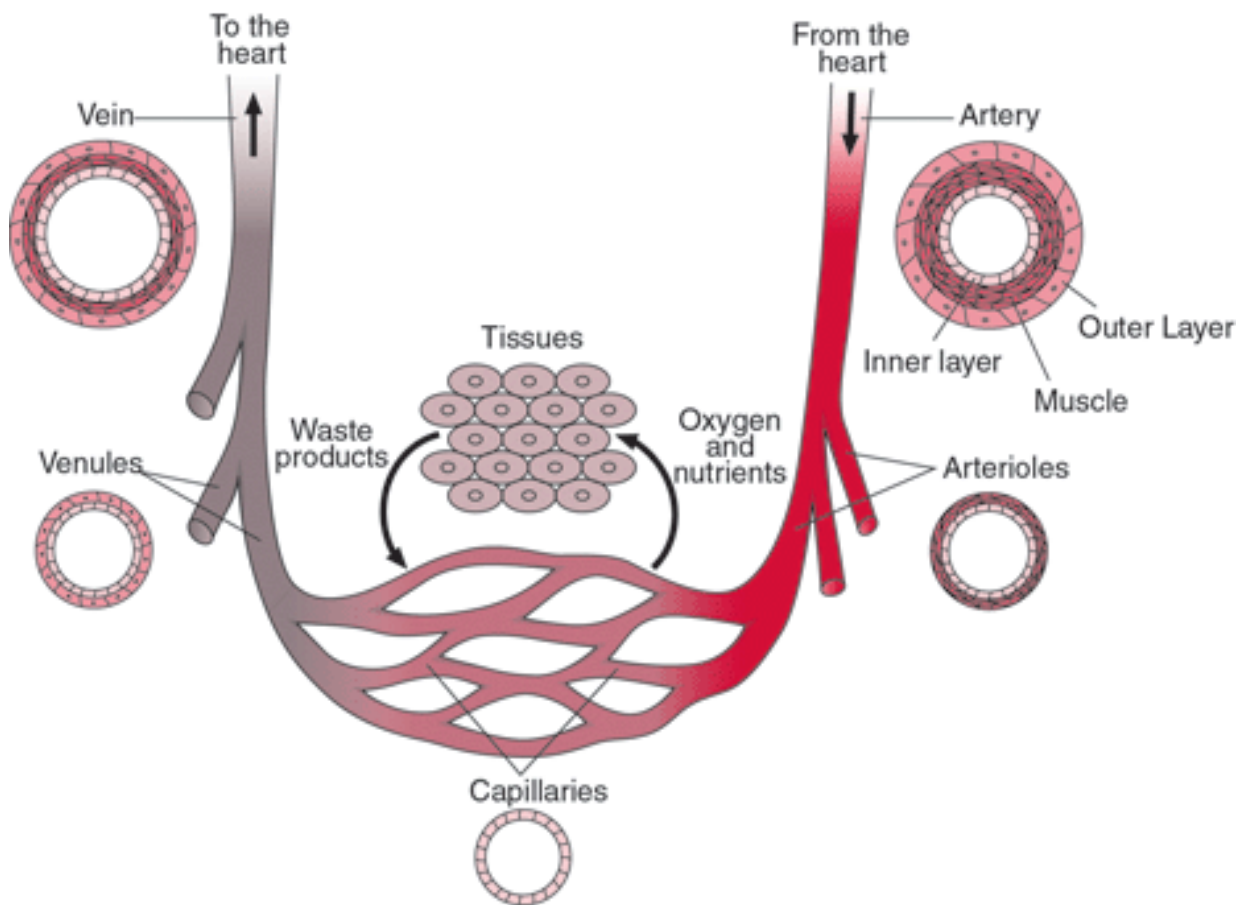


Background

- What does Myoglobin do?
 - Found in muscles.
 - Whales have a lot of it.



Purpose in Muscles





Myoglobin Structure

- 153 residues long, one polypeptide chain.
- 17.2 KDa in “apo” form

- **Primary Sequence**

1 *m*glsdgewql vlnvwgkvea dipghgqevl irlfkghpet lekfdkfkhl ksedemkase
61 dlkkhgatevl talggilkkk ghheaeikpl aqshatkiki pvkylefise ciiqvlqskh
121 pgdfgadaqg amnkalelfr kdmasnykel gfgg



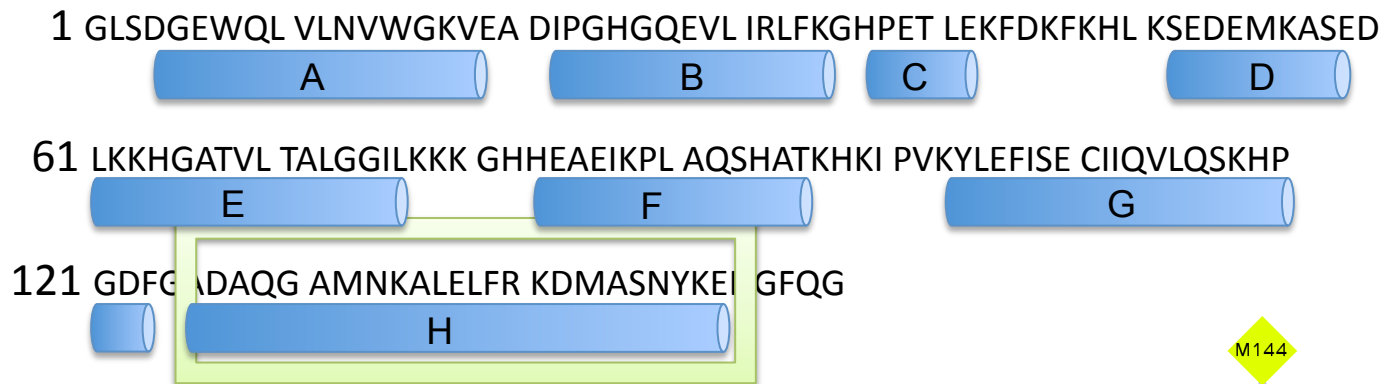
Distribution of amino acids

AMINO ACID			SIDE CHAIN		AMINO ACID			SIDE CHAIN	
Aspartic acid	Asp	D	8	22	Alanine	Ala	A	12	77
Glutamic acid	Glu	E	14		Glycine	Gly	G	15	
Arginine	Arg	R	12	Valine	Val	V	7		
Lysine	Lys	K	20	Leucine	Leu	L	17		
Histidine	His	H	9	Isoleucine	Ile	I	8		
Asparagine	Asn	N	3	Proline	Pro	P	5		
Glutamine	Gln	Q	7	Phenylalanine	Phe	F	7		
Serine	Ser	S	7	Methionine	Met	M	3		
Threonine	Thr	T	4	Tryptophan	Trp	W	2		
Tyrosine	Tyr	Y	2	Cysteine	Cys	C	1		

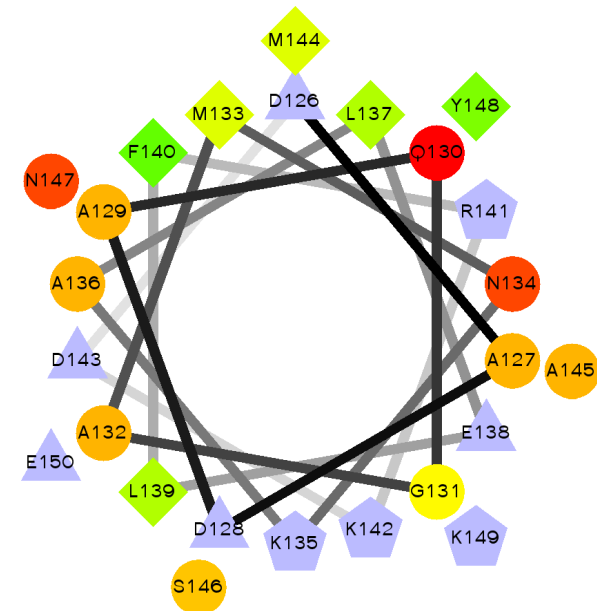
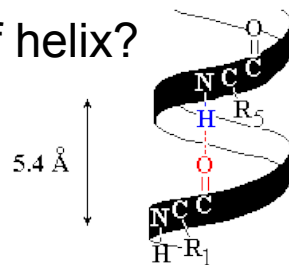
POLAR AMINO ACIDS (hydrophilic)	NONPOLAR AMINO ACIDS (hydrophobic)
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Myoglobin Structure

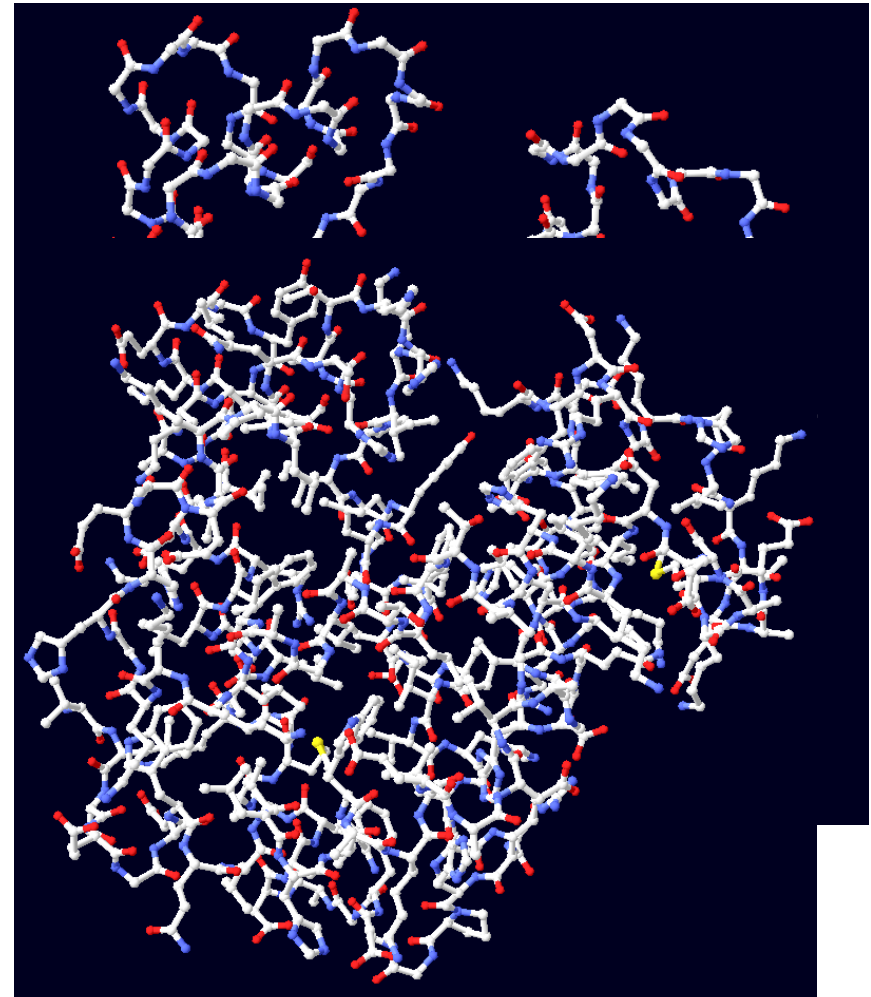
- A Helical protein.



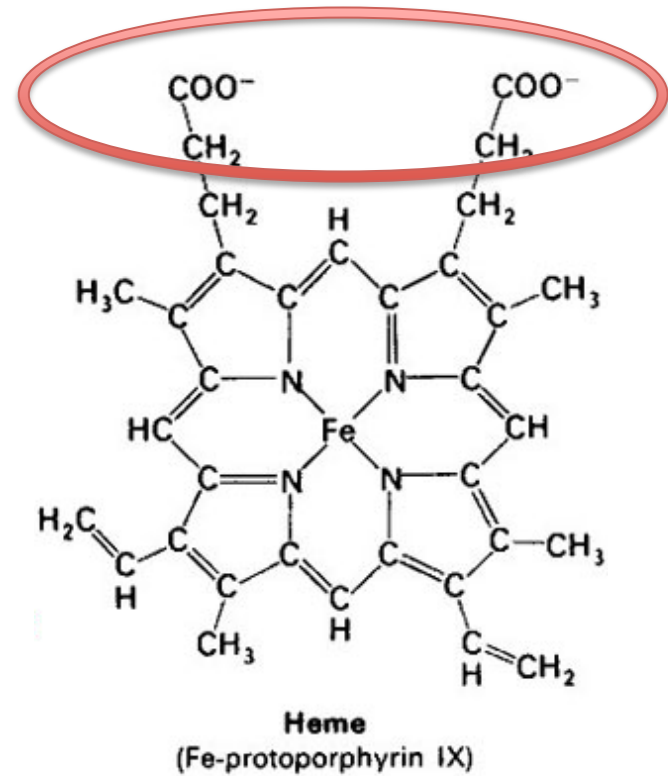
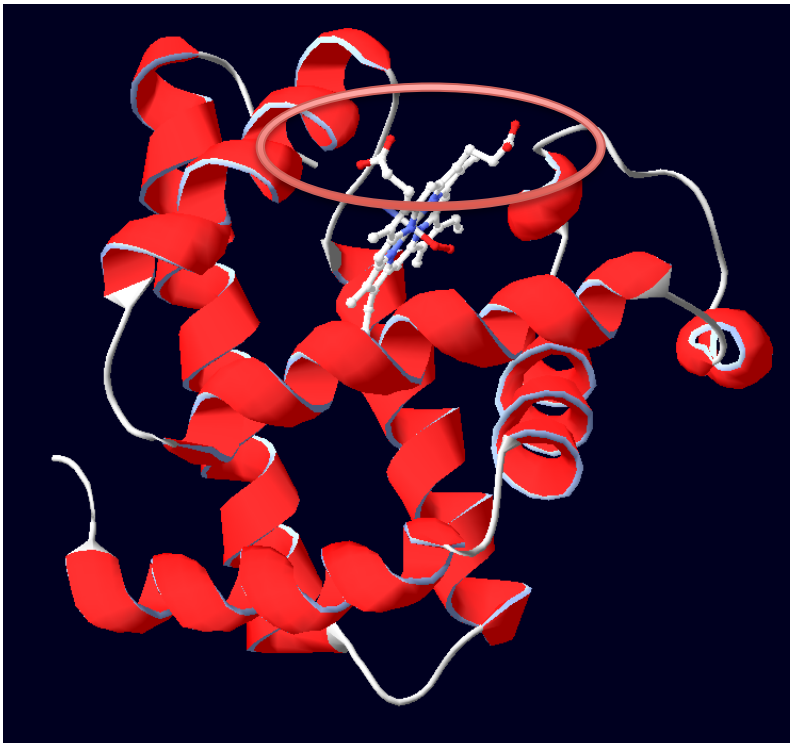
Length of helix?



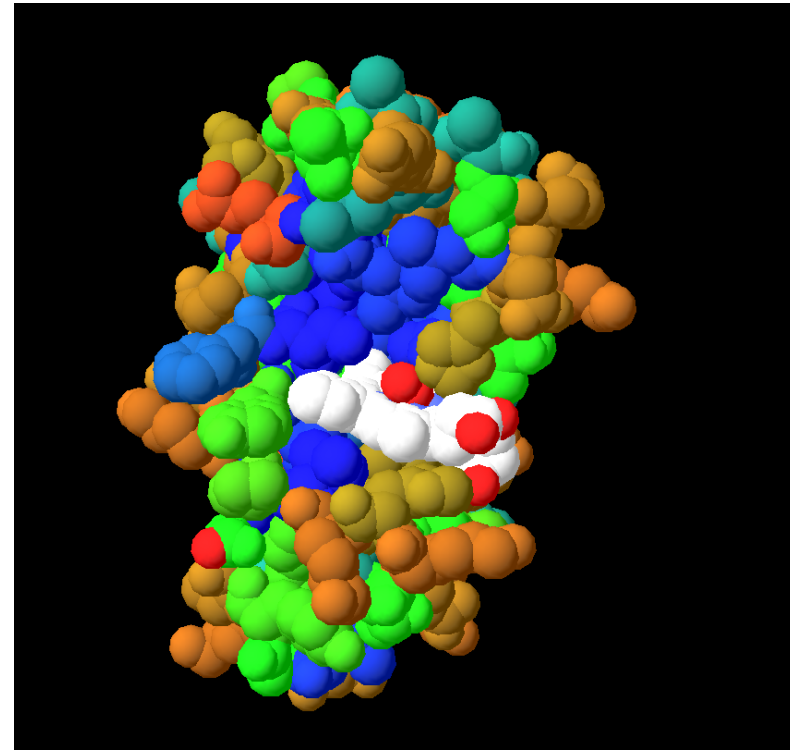
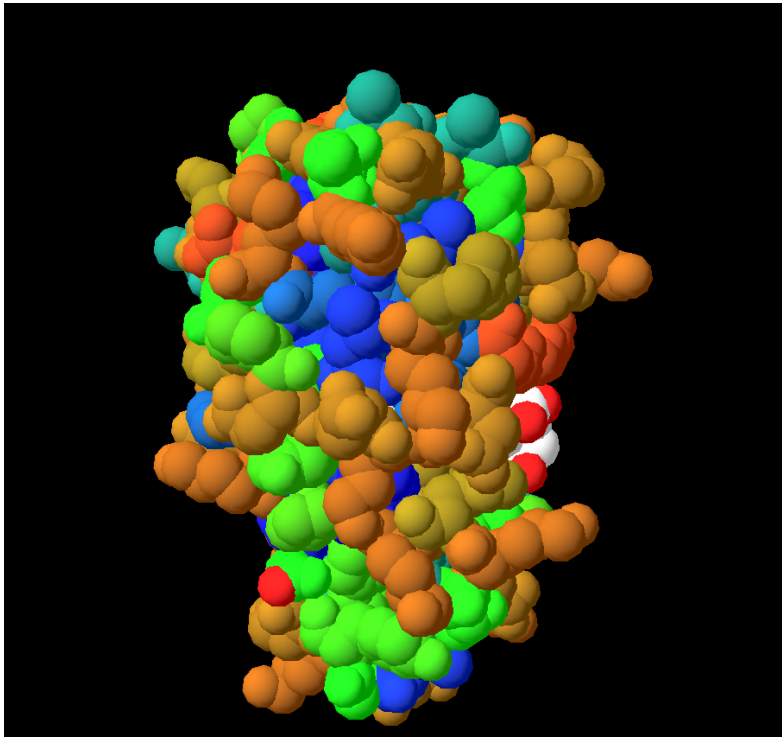
Myoglobin Structure



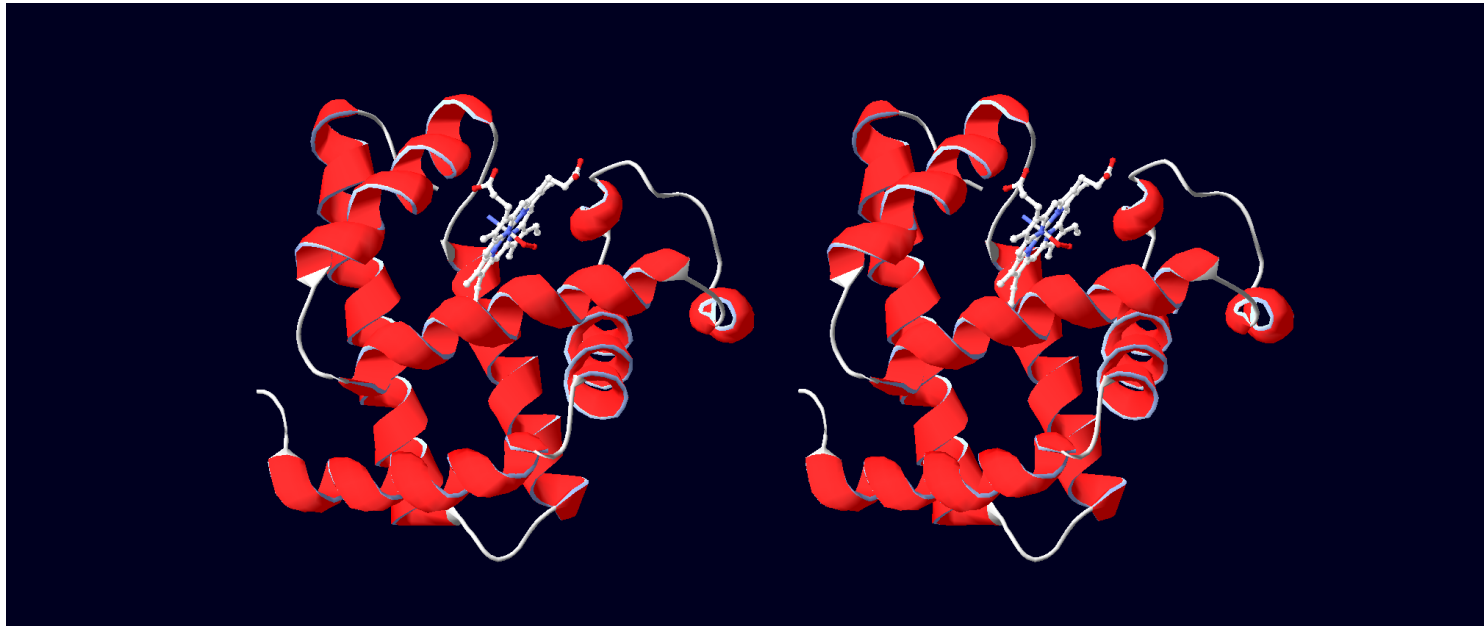
Myoglobin binds Heme



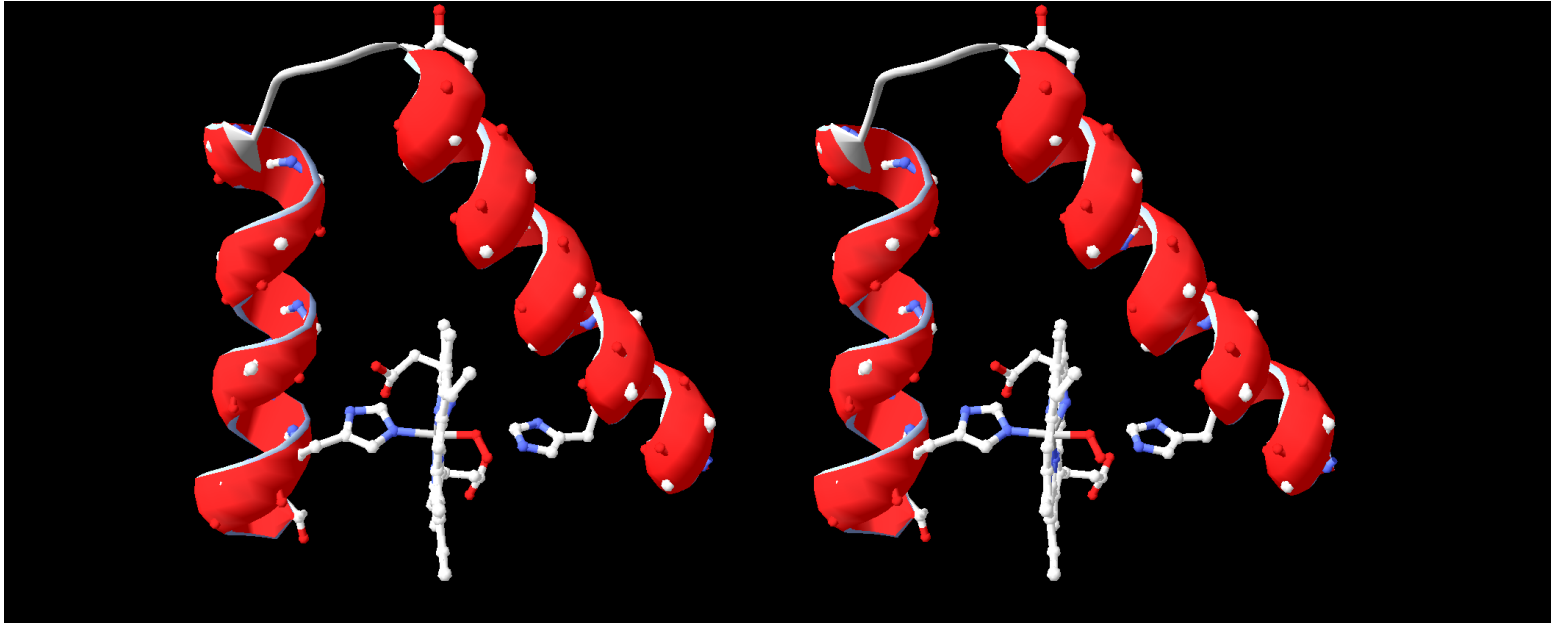
Heme is tightly bound



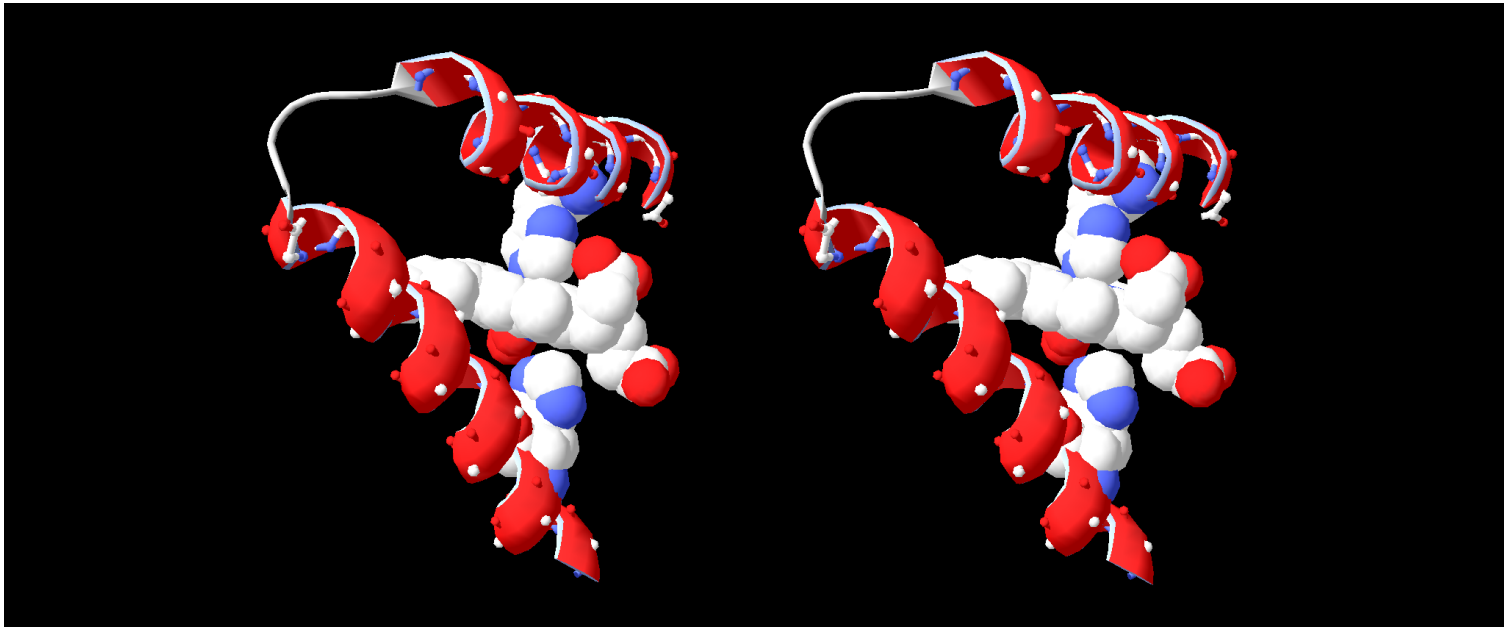
Myoglobin Structure – Heme bound



Structure = Function



So: Myoglobin binds Heme
Heme binds O₂



O₂ Exchanges from Hb to Mb

• HEMOGLOBIN

- Crystal structure is very complicated.
- Hb protein is four subunits, four heme groups, and seems to behave differently when all together as compared with monomers.
- Oxygen saturation curve is “sigmoidal” complicated mathematical formula.

O₂



• MYOGLOBIN

- Crystal structure is very simple
- Mb protein is one subunit, one heme, and behaves simply
- Oxygen saturation curve is hyperbolic, which mathematically is quite simple $y = x/(a+x)$



Oxygen and Myoglobin Exhibit Equilibrium Binding

To the Board!





Key concepts of equilibrium binding

- K_d lets us know the concentrations of two states in Equilibrium
- How does this compare to protein catalysis?





More on Binding Wednesday!

- How Hb is different from Mb.
- What that means in sequence, structure, and function.
- Problem sets on the way...







Quiz grades

out of 40 points

- Average: 22.3
- High 38
- Low 8

