

Introduction to three-dimensional structure of proteins

Definitions

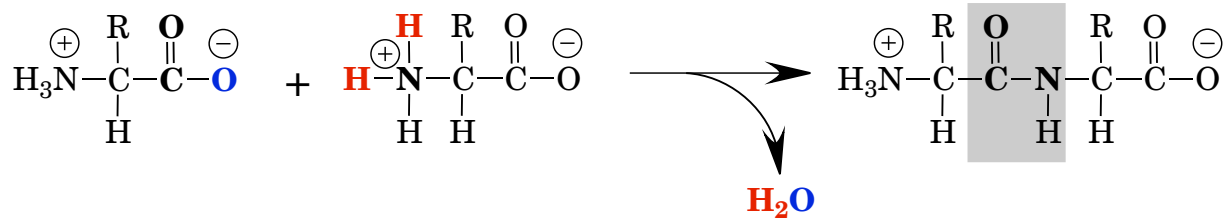
Primary Structure

Secondary Structure

Tertiary Structure

Quaternary Structure

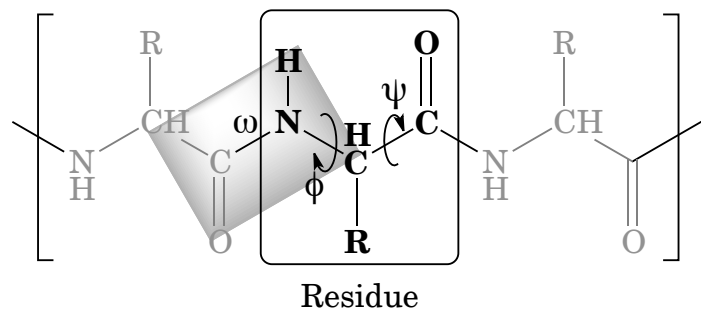
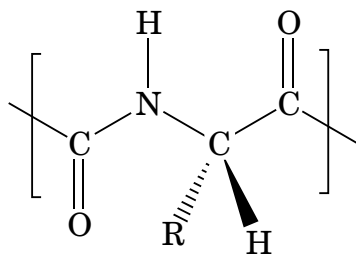
Peptide



Polypeptide

Protein

Residue



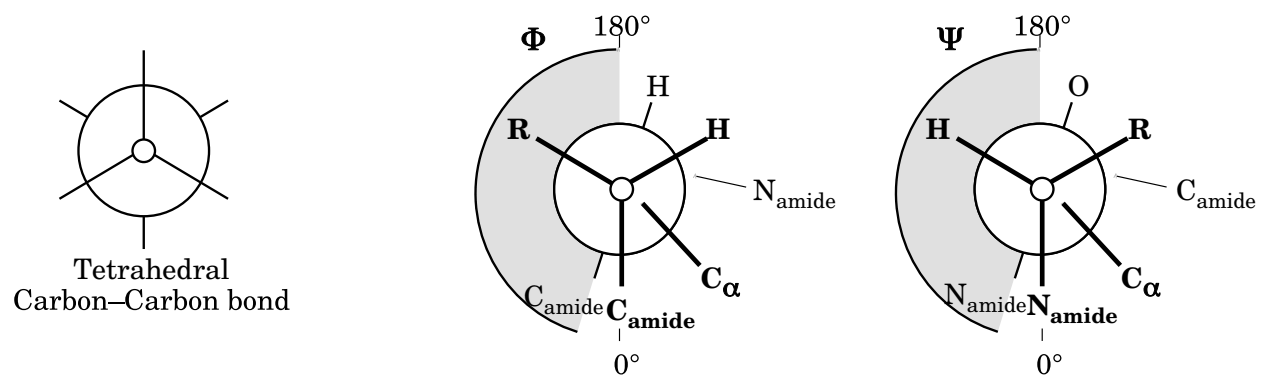
Protein Data Bank (Database of available three dimensional protein structures)
<http://www.rcsb.org/pdb/>

Swiss PDB Viewer (Molecular visualization and manipulation)
<http://www.expasy.ch/spdbv/mainpage.html>

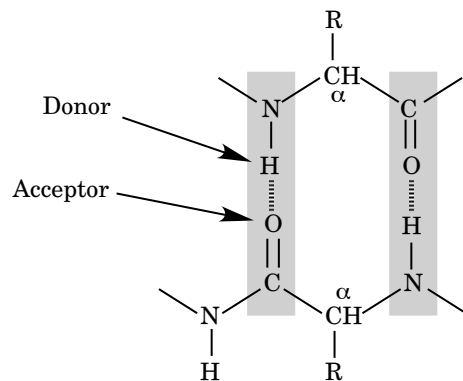
Swiss PDB Viewer Tutorial
<http://www.usm.maine.edu/~rhodes/SPVTut/index.html>

VMD (Molecular visualization and manipulation)
<http://www.ks.uiuc.edu/Research/vmd/>

Dihedral Angles

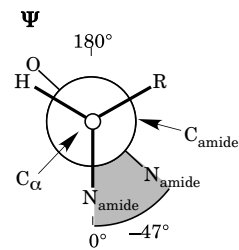
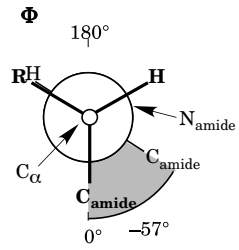


Backbone hydrogen bonds

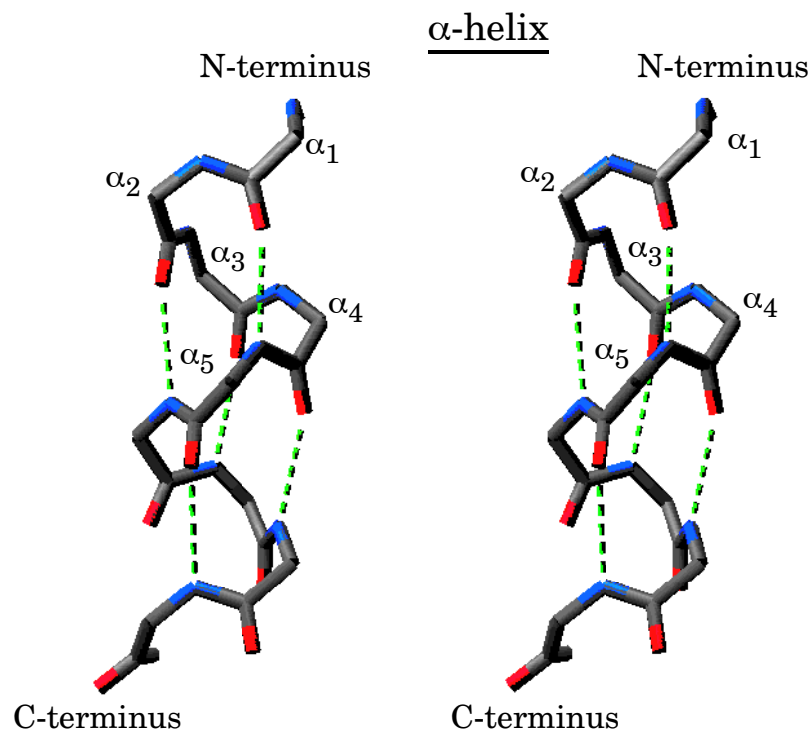


Secondary Structures

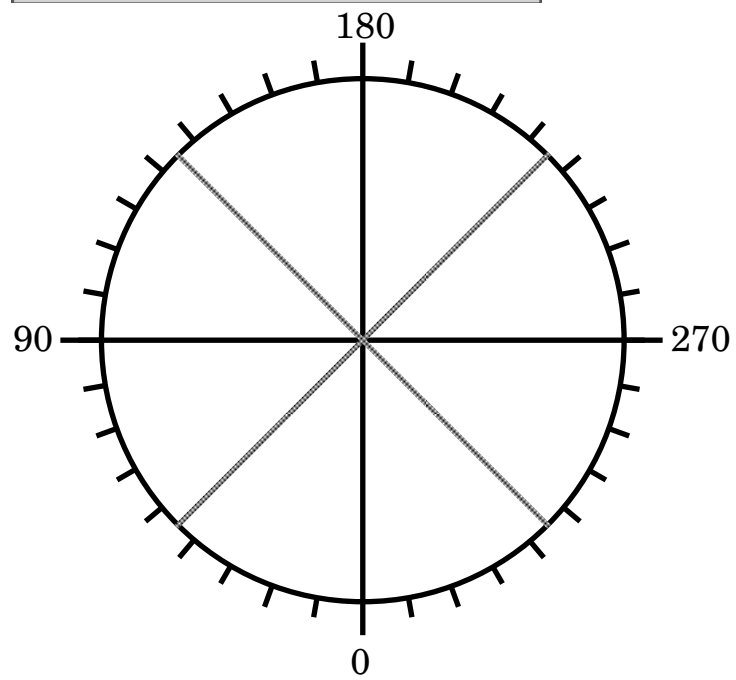
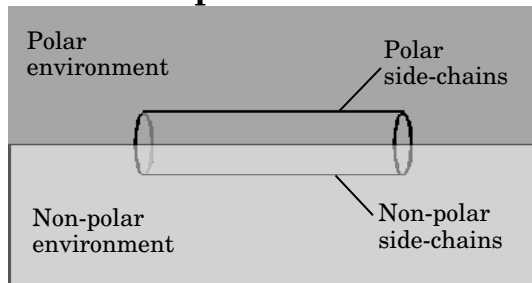
α -helix



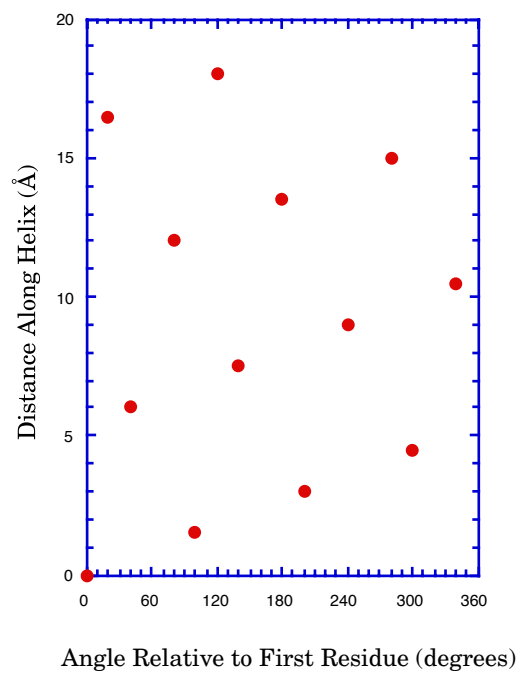
Hydrogen bonds: Carbonyl_i to Amide proton_{i + 4}



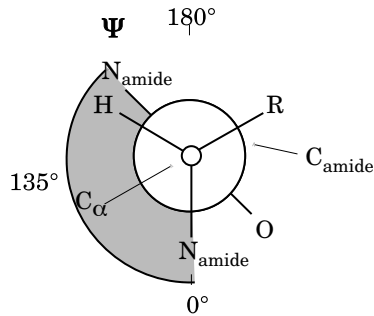
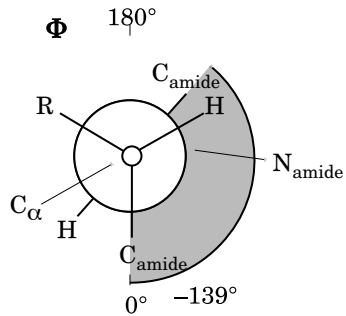
Side-chain patterns



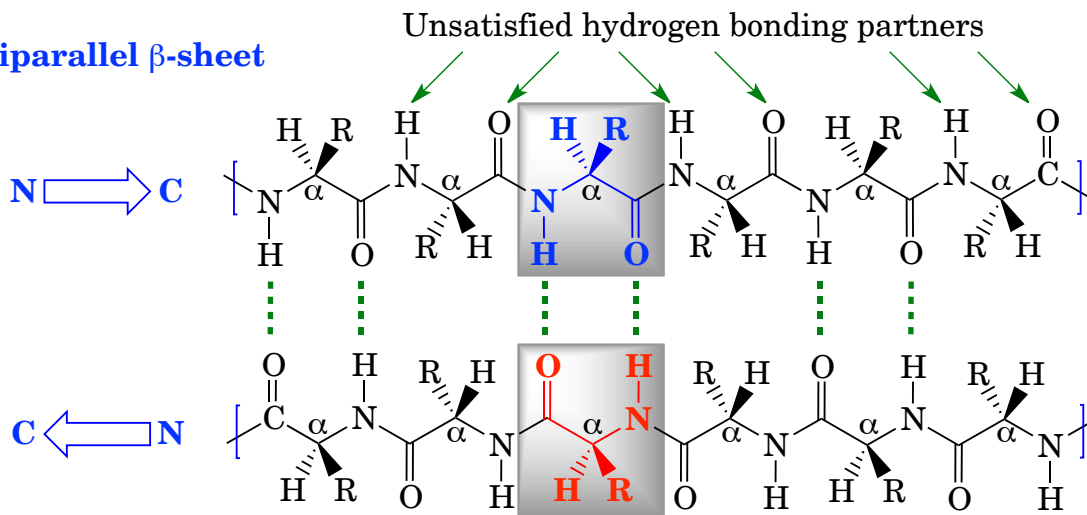
Helical Net



β -sheets

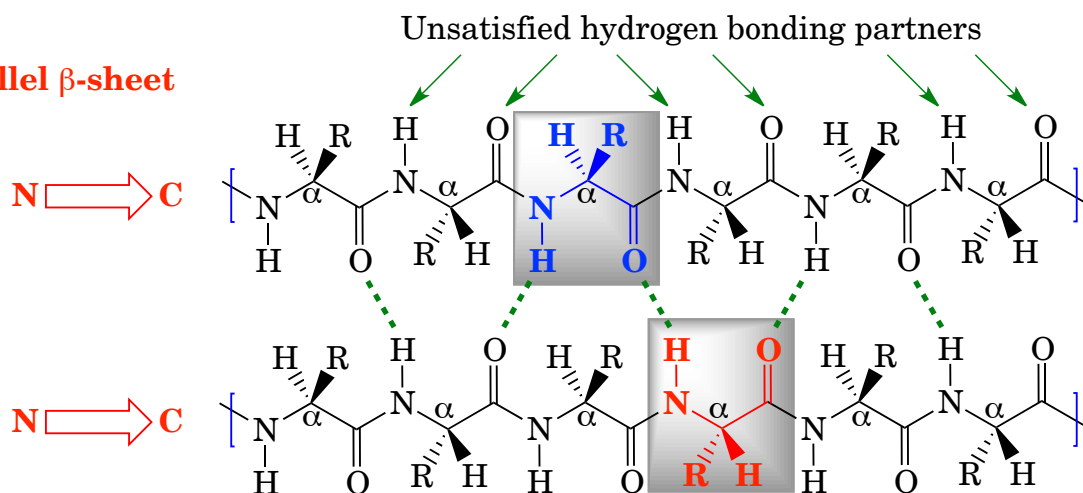


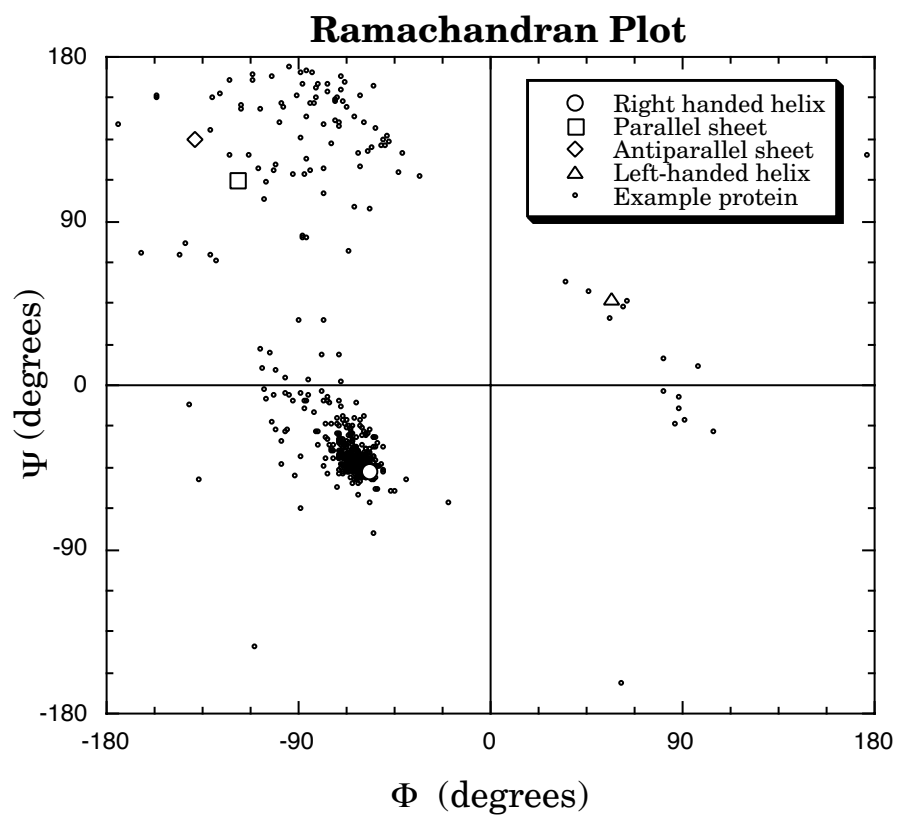
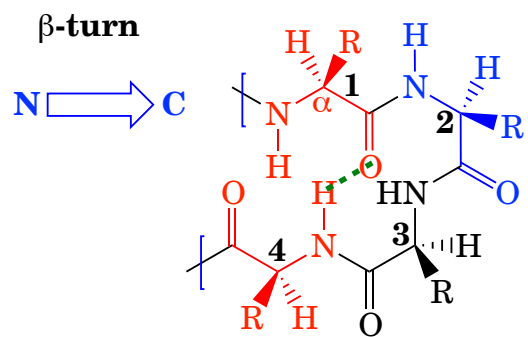
Antiparallel β -sheet



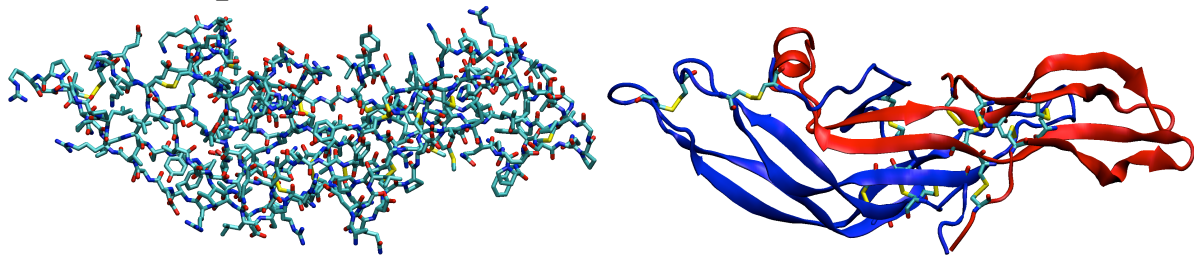
Angle	Antiparallel	Parallel
Φ	-139°	-119°
Ψ	135°	113°

Parallel β -sheet





Protein Representations



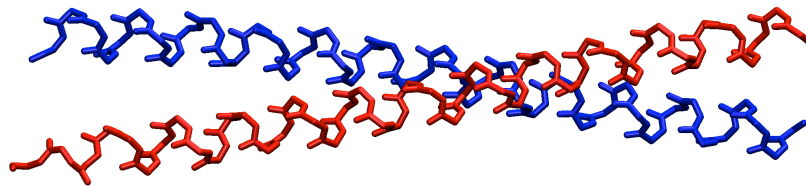
human chorionic gonadotropin (hCG, from PDB ID 1HCN)

Types of Proteins

Secondary structure	Φ	Ψ	Rise per residue
α -helix	-57°	-47°	1.5 Å (3.6 residues per turn)
Coiled-coil	-64°	-42°	1.5 Å
β -sheet (antiparallel)	-139°	135°	3.5 Å
β -sheet (parallel)	-119°	113°	3.5 Å
Collagen	-51°	153°	3 Å

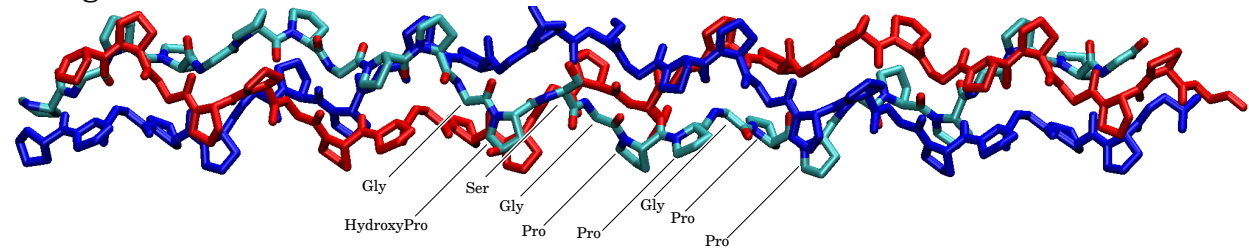
1. Fibrous proteins

Coiled-coil



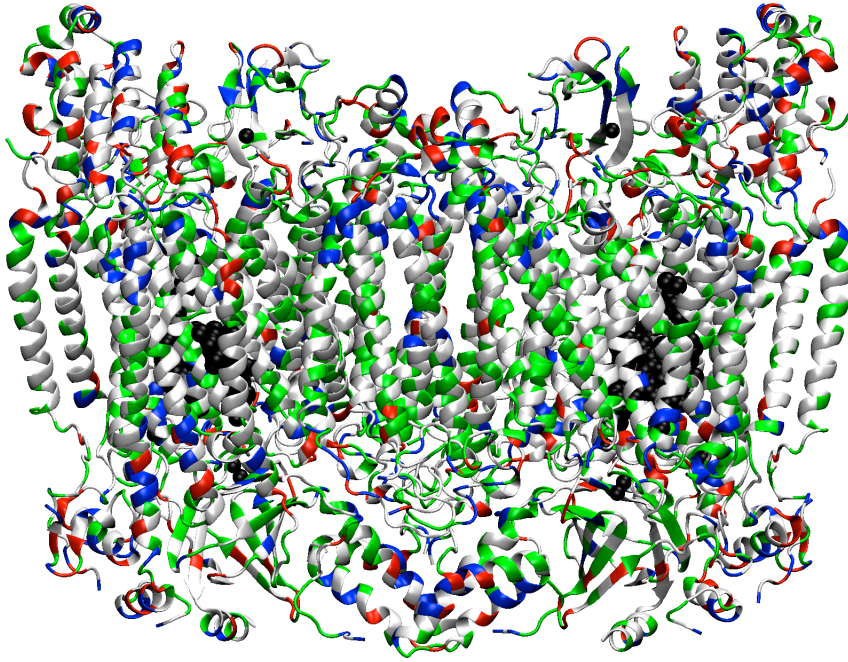
Coiled-coil protein (from PDB ID 3Q0X)

Collagen



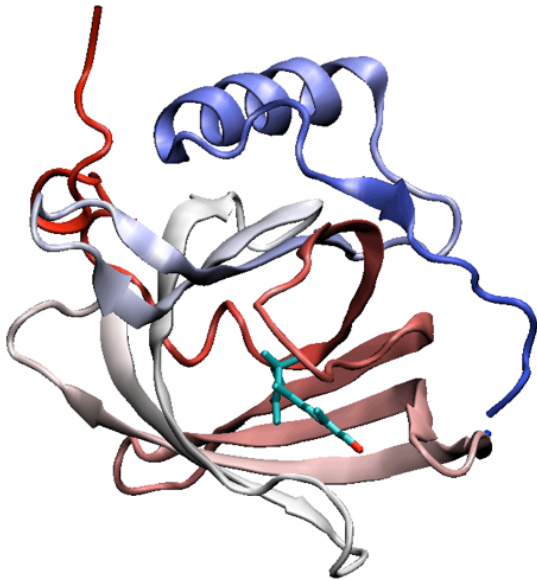
Model collagen peptide (from PDB ID 3ADM)

2. Membrane proteins

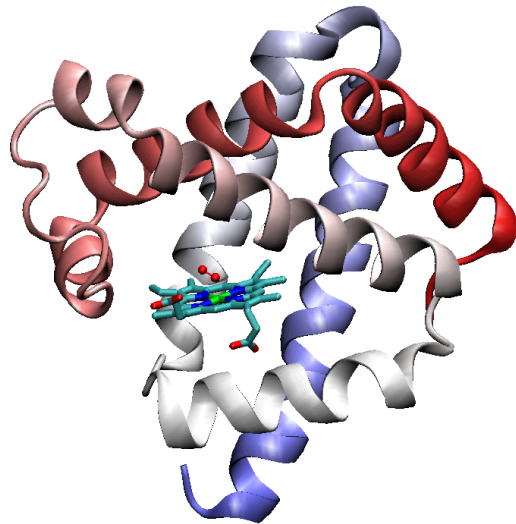


Cytochrome *c* oxidase (from PDB ID 2OCC)

3. Globular proteins



Serum retinol binding protein
(PDB ID 1RBP)



Myoglobin
(PDB ID 1A6M)