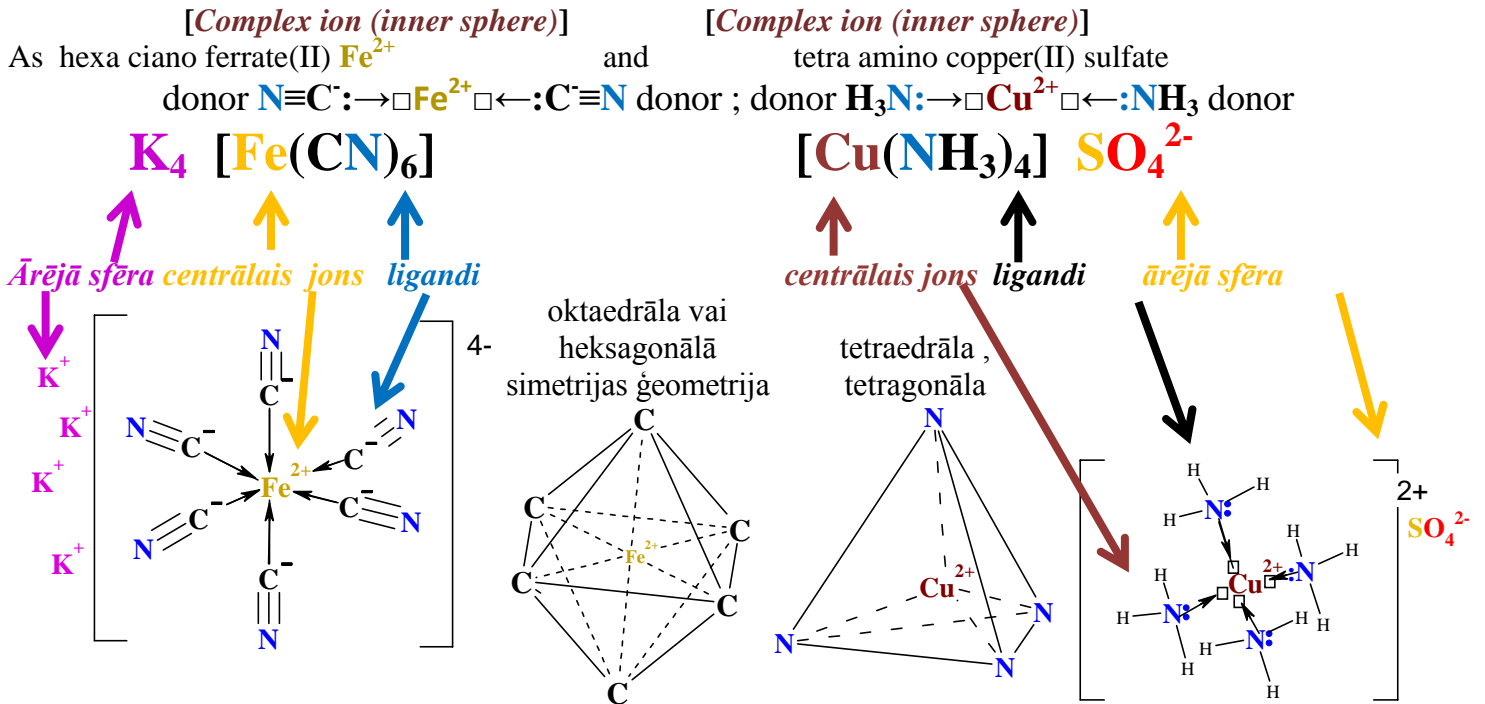


COMPLEX COORDINATIVE COMPOUNDS

Donor :→ □ acceptor bonds form coordinative, complex compounds.

Complex compounds comprise **square brackets [complex]** and designate about complex ion, inner sphere.



Central ion, acceptor is cation of metallic element atom. Have empty electron orbitals □ for accepting.

Ligands – particles connected by donor acceptor bonds: → □ to central ion in symmetrical geometry

Outer sphere – ions that compensate the opposite charge of complex ion as electrolyte

Complexes forms

central symmetric geometric structures figure:

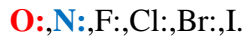
1. Octahedral, hexagonal, bipyramidal figure;
2. Tetrahedral, tetragonal, trigonal pyramid;
3. Trigonal planar triangular figures;
4. Linear, stick shape structure.

Central ion as complex maker – around **metal ion** in symmetric geometry ligands form complex compound **inner sphere**, designated **complex ion** .

Complex compound stability make chemical bonds strength of ligands free electrons pair donor: .

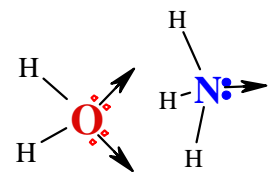
Central ion bound **coordinated account** of **ligands** called about **coordination number**.

Electron pair donors in ligands are atoms with free unshared electron pairs like atoms:



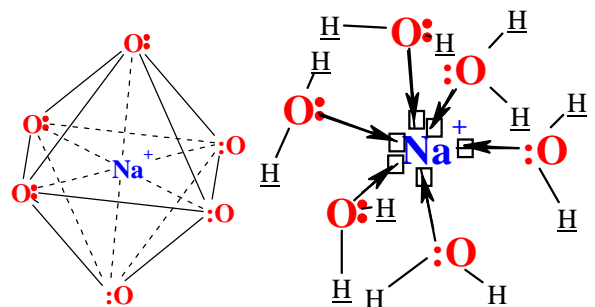
Human organism ligand atoms are two valent oxygen $:\text{O}:$ and tree valent nitrogen $\equiv\text{N}:$.

For example, water molecule H_2O and ammoniac molecule H_3N :



Coordination number calculates **dubling central ion charge** :

Central ions	Central ion charge	Ligand number
Ag^+	+1	2
$\text{Zn}^{2+}, \text{Cu}^{2+}, \text{Pb}^{2+}, \text{Ni}^{2+}$	+2	4
$\text{Al}^{3+}, \text{Cr}^{3+}, \text{Fe}^{3+}$	+3	6
Li^+	+1	4
Na^+, K^+	+1	6
$\text{Mg}^{2+}, \text{Ca}^{2+}, \text{Fe}^{2+}, \text{Co}^{2+}$	+2	6



Ascending coordination complex compounds stability for five type ligands

1. **Aqua** complexes are metal ions Na^+ , K^+ , Mg^{2+} , Ca^{2+} , Fe^{2+} , Co^{2+} in water solution, which coordinate water ligand molecules at hexagonal central symmetry $[\text{Na}^+(\text{H}_2\text{O})_6]$ with coordination number 6. Ligands are electron donors $\text{H}_2\text{O} \rightarrow \square$. Aqua complexes are weaker as other ligands coordinative compounds, which push out from coordination sphere water molecules by stronger donor acceptor bonds.

Central ions are metal element atoms cations

Contains empty electron orbitals \square as acceptors of electron pairs.

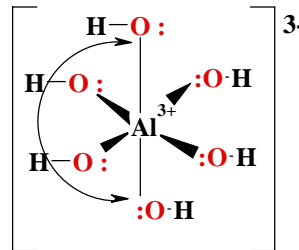
2. **Amino** complex ligands are electron pair donors $\text{H}_3\text{N} \rightarrow \square$

3. **Acido** complex ligands are electron pair donors F^- , Cl^- , Br^- , I^- ,

4. **Hydroxo** complex ligands are much stable electron pair donors to bind acceptor



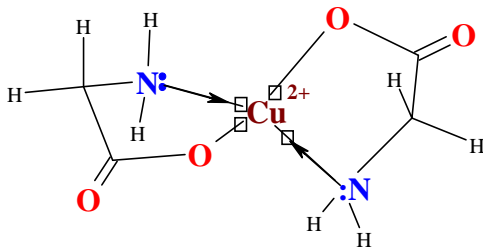
Hexa hydroxo aluminate(III) anion



5. **Polydentate ligands** of chelates, of internal complexes are most stable coordinative compounds in human organism as structural formations of proteins.

Designated in Biochemistry, Physiology about metal enzymes, metal proteins, for example,

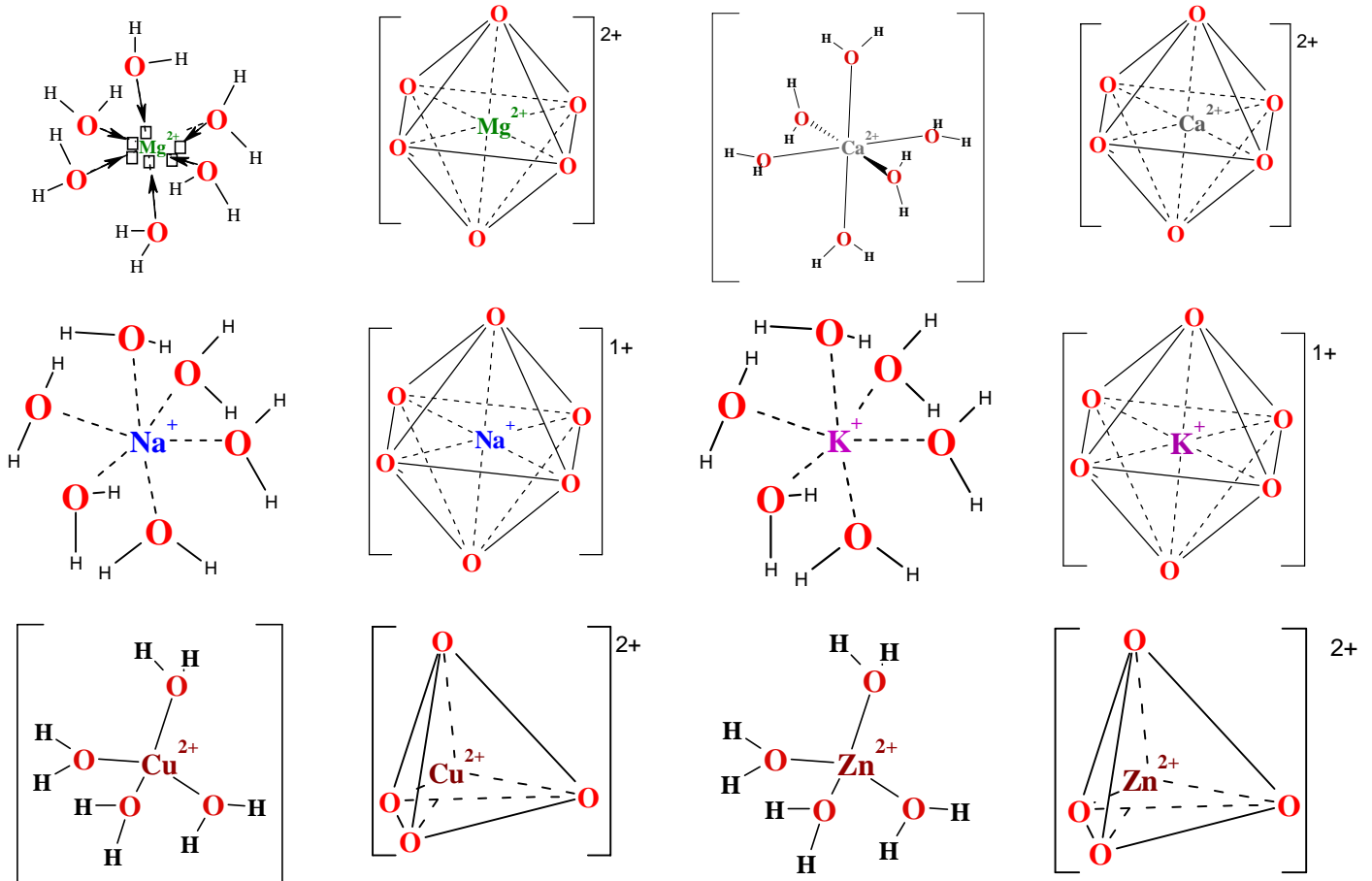
Amino acid glycine internal complex compound



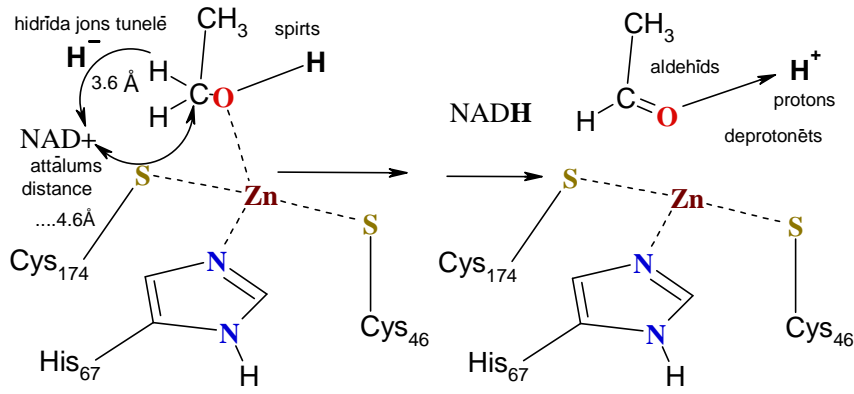
$[\text{Cu}(\text{NH}_2\text{CH}_2\text{COO})_2]$ di amino acetate cooper(II) complex.

Stability increase instant donor acceptor and covalent ionic bond with two glycine molecules and both molecules perpendicular planes.

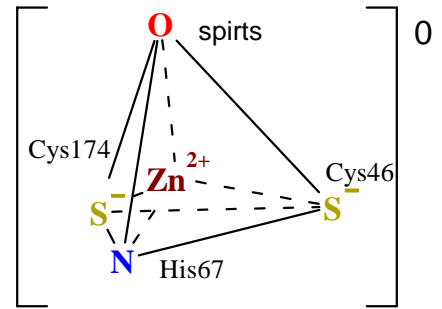
Metal ions Mg^{2+} , Ca^{2+} , Na^+ , K^+ , Cu^{2+} , Zn^{2+} central symmetry geometry in human organism aqua complexes



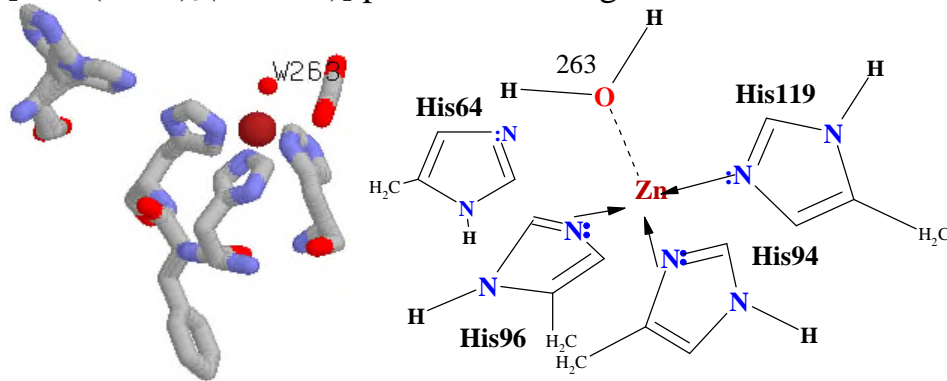
Alcohol dehydrogenase E.1 class enzyme 1HLD.pdb Zn^{2+} coordinates Cys46-Cys174-His67-*alcohol*:
 $[Zn^{2+}(S^-Cys)_2(Oalcohol)(NHis)]$ complex neutral zero charge .



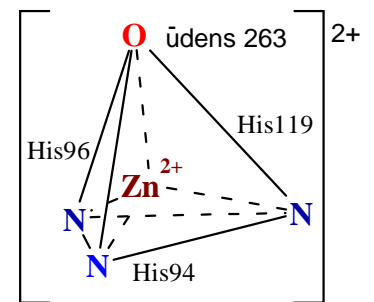
Tetrahedral , Tetragonal geometry with zero charge



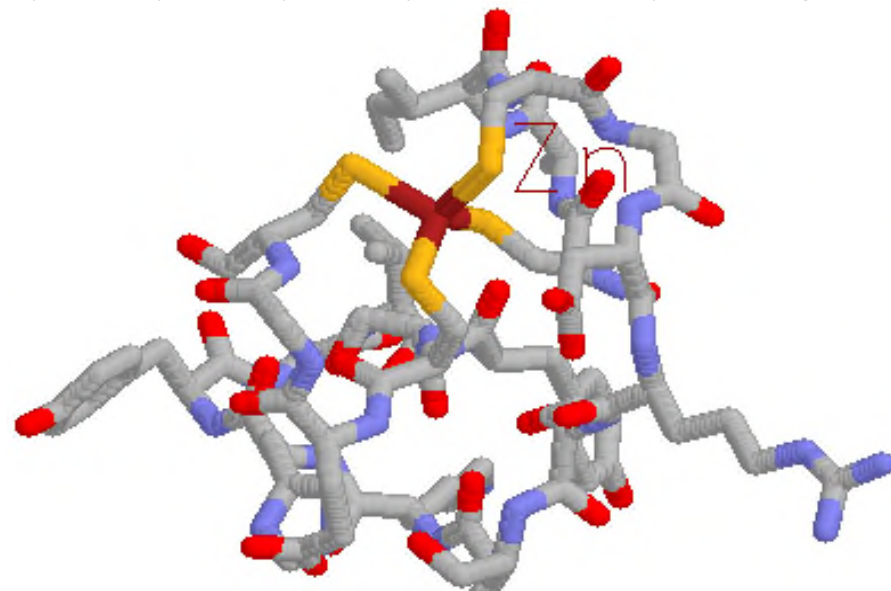
Carbonic anhydrase E.2 class enzyme 2VVA.pdb Zn^{2+} coordinates His96-His94-His119-*water*
 $[Zn^{2+}(NHis)_3(Owater)]$ positive +2 charge.



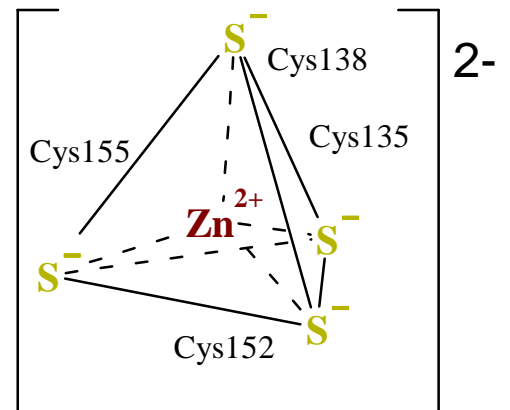
Tetrahedral , Tetragonal geometry with +2 charge



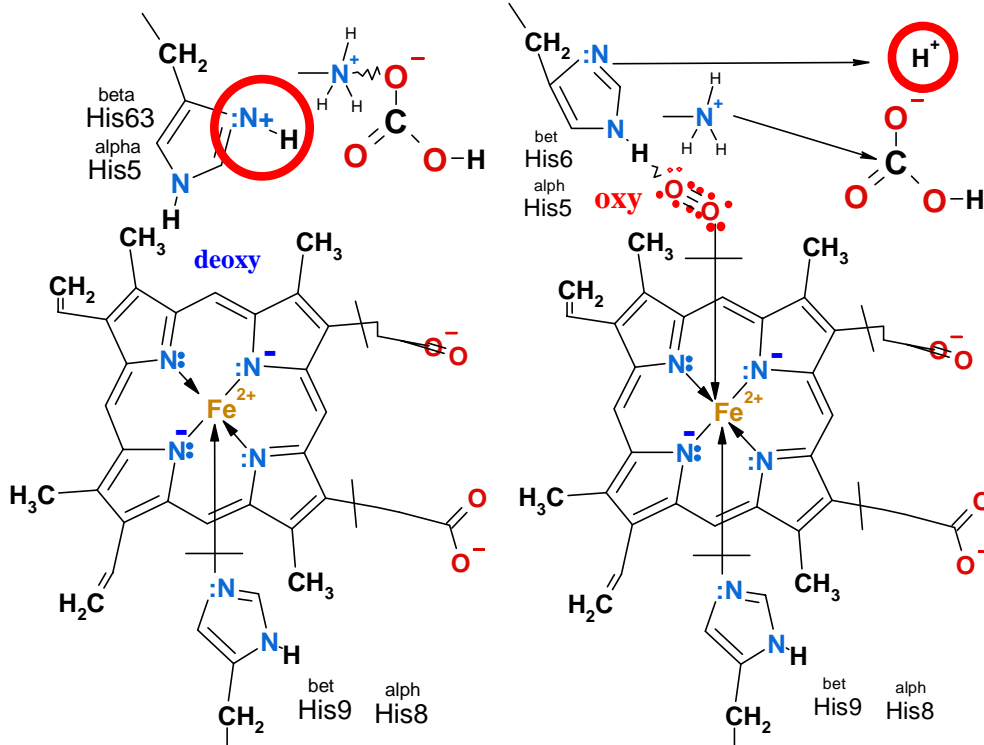
Zink finger motif DNA binding enzyme 3DZY.pdb Zn^{2+} coordinates Cys138-Cys135-Cys152-Cys155 $[Zn^{2+}(S^-Cys)_4]^{2-}$ negative -2 complex charge.



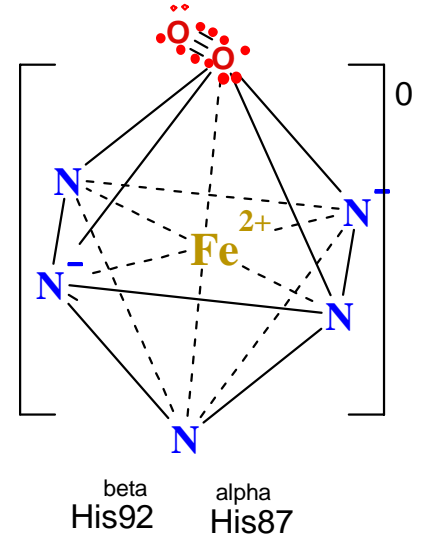
Tetrahedral , Tetragonal Geometry ion charge -2



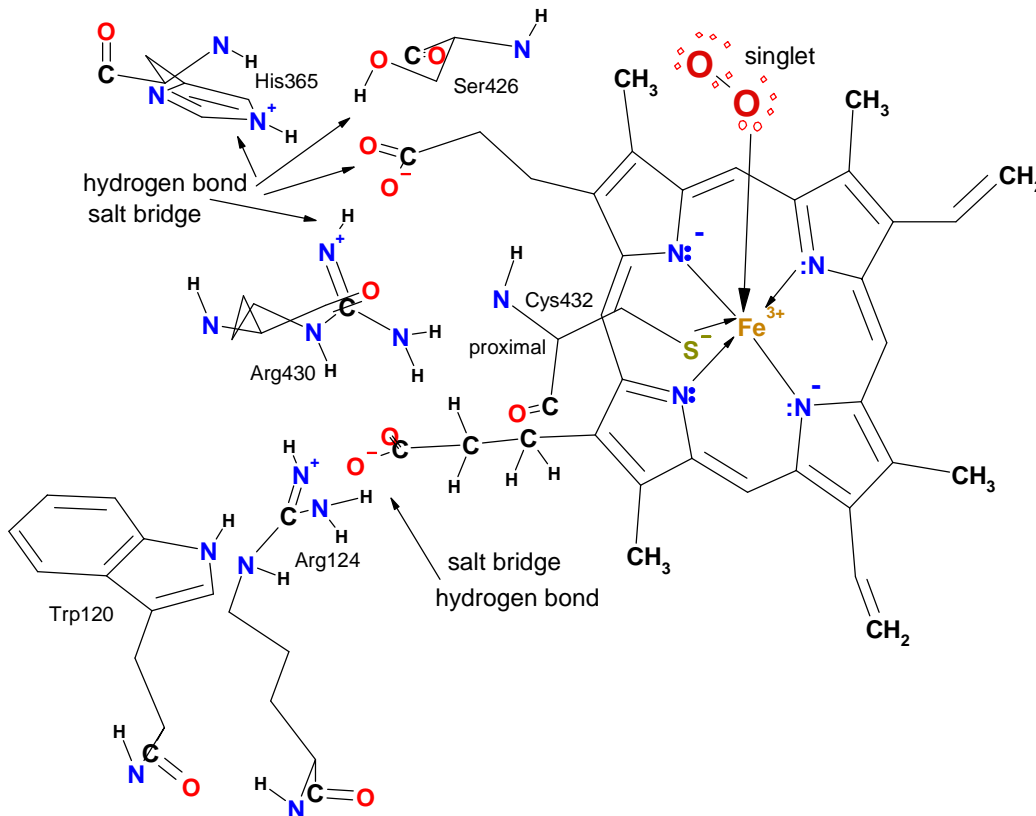
Shuttle hemoglobin **deoxy-oxy Fe²⁺** coordinates hem **N⁻-N⁻-N⁻-N⁻His63,58-O≡O triplet oxygen** [**Fe²⁺(N⁻hem)₄(N⁻ His63,58)(O≡O triplet oxygen)**]neutral zero 0 net charge of complex.0.



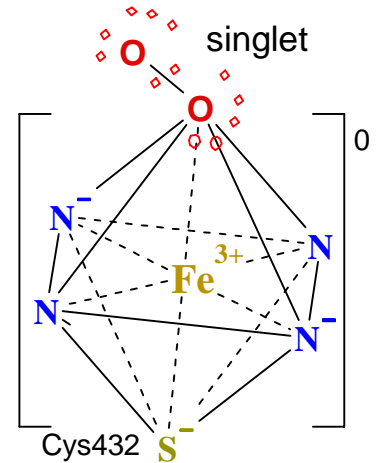
Octahedral , Hexagonal ,
Bipyramidal geometry
with zero charge



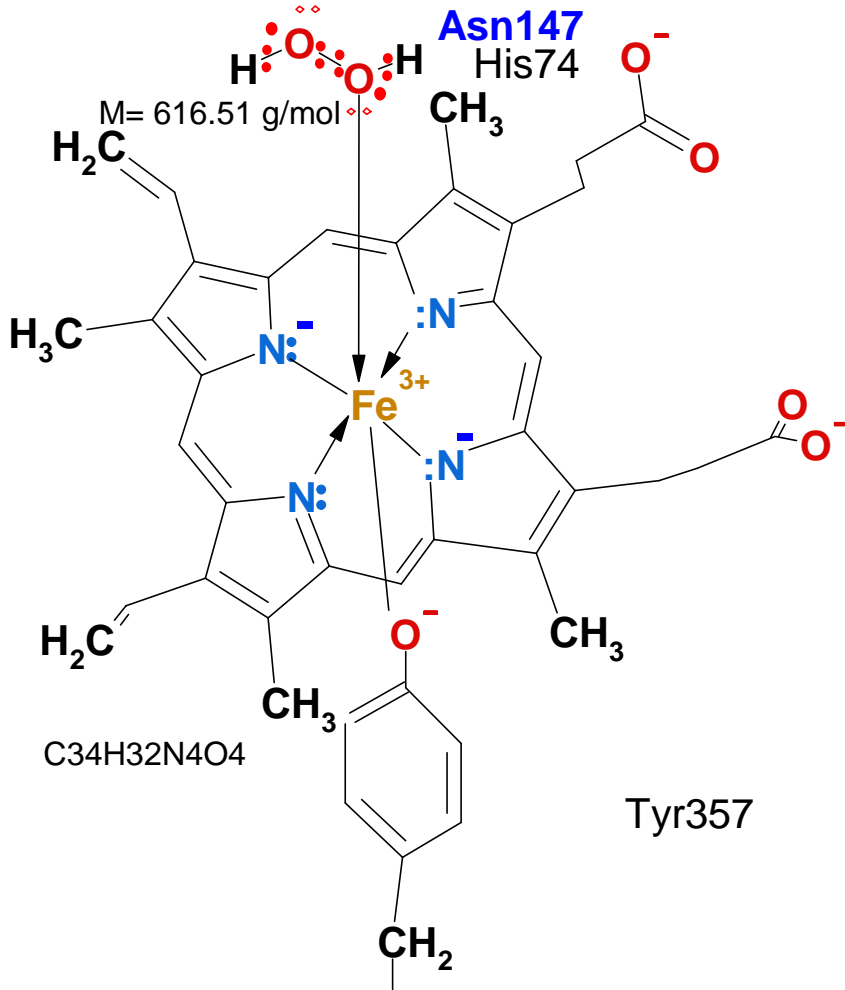
Cytochrome P450 **Fe³⁺** coordinates hem **N⁻-N⁻-N⁻-N⁻-S⁻Cys432-O-O singlet oxygen** [**Fe³⁺(N⁻ hem)₄(S⁻Cys432)(O-O oxygen singlet)**]neutral zero 0 net charge of complex..



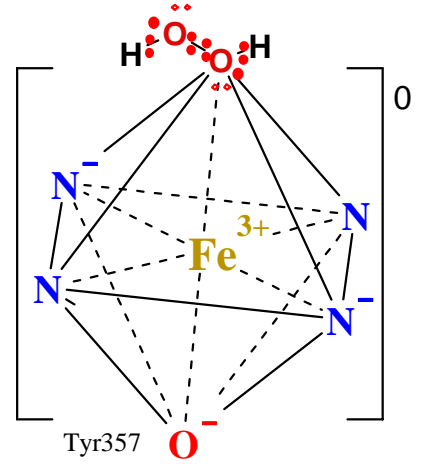
Octahedral , Hexagonal,
Bipyramidal geometry with
neutral charge zero:



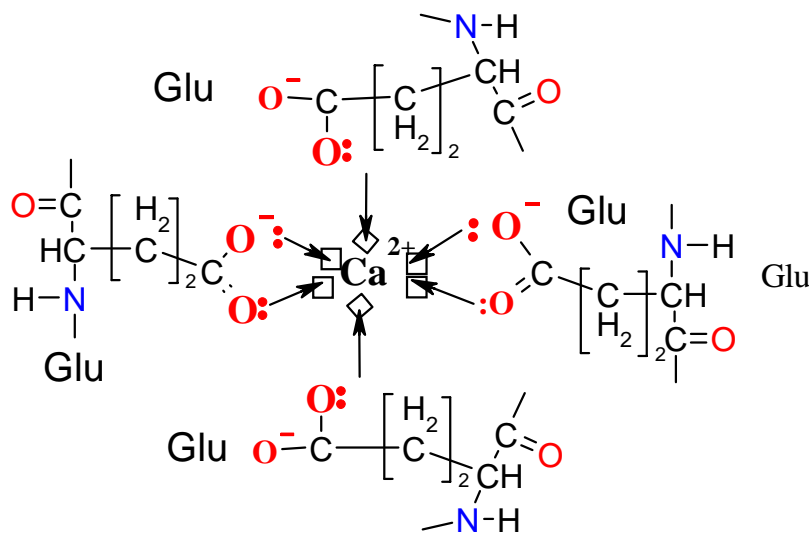
Catalase (EC 1.11.1.6) Fe^{3+} coordinates hem $\text{N-N}^--\text{N-N}^--\text{O}^-$ -Tyr357- HO-OH peroxide
 $[\text{Fe}^{3+}(\text{N hem})_4(\text{O}^- \text{Tyr357})(\text{HO-OH peroxide})]$ neutral zero 0 net charge of complex..



Hexagonal , Octahedral ,
Bipyramidal geometry:



Myosin contraction Ca^{2+} coordinates four glutamate $-\text{COO}^-$ carboxylate six oxygen atoms
 $[\text{Ca}^{2+} (\text{Glu}-\text{COO}^-)_4 \text{ with } 4 (\text{Glu}-\text{O}^-)_4 \text{ and two } \text{Glu}-\text{C}=\text{O}]$ complex charge negative minus two 2- ...



Octahedral , Hexagonal , Bipyramidal
geometry with minus -2 charge:

