

Bioinorganic Chemistry Glossar

Active center: Location in an enzyme where the specific reaction takes place.

ADP: Adenosine-5'-diphosphate.

Allosteric effect: The binding of a ligand to one site on a protein molecule in such a way that the properties of another site on the same protein are affected.

Allosteric enzyme: Can bind a small regulatory molecule that influences catalytic activity.

Apo-enzyme: An enzyme that lacks its metal center or prosthetic groups.

Assimilation: Processes of the up-take of vitamins, minerals, and other chemicals from food, water or the atmosphere as part of the nutrition of an organism. Photosynthesis and Nitrogen fixation are the most important biological assimilation processes.

ATP: Adenosine-5'-triphosphate.

Bio membrane: Sheet like assemblies of proteins and lipids (bilayer).

Calmodulin: Ca²⁺-binding protein involved in metabolic regulation.

Carboanhydrase: Zn-containing enzyme that catalyzes the reversible decomposition of carbonic acid to carbon dioxide and water.

Charge-transfer complex: An aggregate of two or more molecules in which charge is transferred from a donor to an acceptor.

Chlorin: 2,3-Dihydroporphyrin, reduced porphyrin with two non-fused saturated carbon atoms (C-2, C-3) in one of the pyrrole rings.

Chlorophyll: Magnesium complex of a porphyrin in which a double bond in one of the pyrrole rings (17-18) has been reduced. A fused cyclopentanone ring is also present.

Cisplatin: Cis-diammine dichloro platinum(II), antitumor drug. Of major importance in the antitumor activity of this drug is its interaction with the nucleic acid bases of DNA.

Cluster: Metal centers grouped close together which can have direct metal bonding or through a bridging ligand, e.g. ferredoxin.

Cobalamin: Vitamin B12, substituted corrin-Co(III) complex.

Coenzyme: A low-molecular-weight, non-protein organic compound (often a nucleotide) participating in enzymatic reactions.

Cofactor: An organic molecule or ion (usually a metal ion) that is required by an enzyme for its activity. It may be attached either loosely (coenzyme) or tightly (prosthetic group).

Co-operativity: The phenomenon that binding of an effectormolecule to a biological system either enhances or diminishes the binding of successive molecules, e.g. hemoglobin.

Corrin: Ring-contracted porphyrin derivative that is missing a carbon.

CTP: Cytosine-5'-triphosphate.

Cyclic adenosine monophosphate (cAMP): Cyclic nucleotide derived from adenosine triphosphate (ATP), which can act as a second messenger.

Cyclic guanosine monophosphate (cGMP): Cyclic nucleotide derived from guanosine triphosphate (GTP), which can act as a second messenger.

Cytochrome: Heme protein that transfers electrons, and exhibits intense absorption bands. The iron undergoes oxidation-reduction between oxidation states Fe(II) and Fe(III).

Cytochrome oxidase: The major respiratory protein of animal and plant mitochondria. It catalyzes the oxidation of Fe(II)-cytochromec, the reduction of dioxygen to water, and contains two hemes and three copper atoms, arranged in three centers.

Cytochrome P-450: General term for a group of heme-containing monooxygenases. The reaction with dioxygen appears to involve higher oxidation states of iron, such as Fe(IV)=O.

Cytoplasm: The part of protoplasm in a cell outside of and surrounding the nucleus.

Dehydrogenase: An oxidoreductase which catalyzes the removal of hydrogen.

Desferrioxamine (dfo): Chelating agent used world-wide in the treatment of iron overload conditions, such as hemochromatosis and thalassemia.

Dismutase: Enzyme that catalyzes a disproportionationreaction.

Dissimilation: Processes leading to the breakdown of more complex substances into simpler ones upon the release of energy.

Entatic state: A state of an atom or group which has its geometric or electronic condition adapted for function. The term is derived from the word entasis (Greek) meaning tension.

Enzyme: A macromolecule that functions as a biocatalyst by increasing the reaction rate.

FeMo-cofactor: An inorganic cluster found in the FeMo protein of the molybdenum-nitrogenase, essential for the catalytic reduction of N₂ to ammonia.

Ferredoxin: A protein containing more than one iron and acid-labile sulfur, that displays electron-transfer activity but not classical enzyme function.

Ferritin: An iron storage protein consisting of a shell of 24 protein subunits, encapsulating up to 4500 iron atoms in the form of a hydrated iron(III) oxide.

GTP: Guanosine-5'-triphosphate.

Heme: A near-planar coordination complex obtained from iron and dianionic porphyrin.

Hemerythrin: A dioxygen-carrying protein from marine invertebrates, containing an oxo-bridged dinuclear iron center.

Hemocyanin: A dioxygen-carrying protein (from invertebrates, e.g. arthropods and molluscs), containing dinuclear type 3 copper sites.

Hemoglobin: A dioxygen-carrying heme protein of red blood cells

HiPIP: High-Potential Iron-sulfur Protein (ferredoxin). Cluster which undergoes oxidation-reduction between the [4Fe-4S]²⁺ and [4Fe-4S]³⁺ states.

Holo enzyme: An enzyme containing its characteristic prosthetic group(s) and/or metal(s).

Ion channel: Enable ions to flow rapidly through membranes in a thermodynamically downhill direction after an electrical or chemical impulse. Their structures usually consist of 4-6 membrane-spanning domains. This number determines the size of the pore and thus the size of the ion to be transported.

Ionophore: A compound which can carry specific ions through membranes.

Ion pumps: Enable ions to flow through membranes in a thermodynamically uphill direction by the use of an energy source. They open and close upon the binding and subsequent hydrolysis of ATP, usually transporting more than one ion towards the outside or the inside of the membrane.

Metallo enzyme: An enzyme that, in the active state, contains one or more metal ions.

Mitochondria: Cytoplasmic organelles, which produce ATP by oxidative phosphorylation.

Model: A synthetic coordination entity that closely approaches the properties of a metal ion in a protein and yields useful information concerning biological structure and function

Myoglobin: An iron containing monomeric dioxygen-binding heme protein of muscle tissue, structurally similar to a subunit of hemoglobin.

Nucleic acids: Macromolecules composed of sequences of nucleotides that perform several functions in living cells, e.g. the storage of genetic information.

Nucleosides: Compounds in which a purine or pyrimidine base is beta-N-glycosidically bound to C-1 of either 2-deoxy-D-ribose or of D-ribose, but without any phosphate groups.

Nucleotides: Nucleosides with one or more phosphate group esterified mainly to the 3'-or the 5'-position of the sugar moiety.

OEC: Oxygen-Evolving Complex. It is the site of water oxidation. It is a M-oxo cluster comprising four manganese ions (in oxidation states ranging from +II to +IV) and one divalent calcium ion.

Photosynthesis: A metabolic process in plants and certain autotrophic bacteria, using light energy absorbed by chlorophyll and other photosynthetic pigments for the reduction of CO₂, followed by the formation of organic compounds.

Plastocyanin: An electron transfer protein, containing a type 1 copper site, involved in plant and cyanobacterial photosynthesis, which transfers electrons to Photosystem 1.

PS1: Photo system 1, protein complex which catalysis the oxidation of plastocyanine and the reduction of ferredoxin upon the absorption of photons

PS2: Photo system 2, protein complex which catalysis the reduction of plastoquinone to plastoquinol. The energized electrons are replaced by oxidizing water to form hydrogen ions and molecular oxygen. Both protein complexes are located in the thylakoid membrane of plants, algae, and cyanobacteria.

Prosthetic Group: The tightly bound, non-protein portion of an enzyme but essential for its function; they differ from coenzymes in that they are more firmly attached (usually permanently) to the enzyme protein; e.g. the Fe containing heme group present in cytochromes.

Rieske protein: An iron-sulfur protein of the mitochondrial respiratory chain, containing a [2Fe-2S] cluster.

Rubredoxin: An single iron-sulfur protein, function as an electron carrier.

SOD: Superoxide dismutase, catalysis the disproportionation of superoxide.

Soret band: Strong absorption band in the blue region of the optical absorption spectrum of a heme protein.

Substrate: A compound that is transformed under the influence of a catalyst.

Template: A molecular “mold“, which shapes the structure or sequence of another molecule, e.g. the nucleotide sequence of DNA acts as a template to control the nucleotide sequence of RNA during transcription.

Trace elements: Elements required for physiological functions in very small amounts, e.g. Co, Cu, F, Fe, I, Mn, Mo, Ni, Se, V, W, and Zn.

TTP: Thymine-5'-triphosphate.

Type 1,2,3 copper: Different classes of copper-binding sites in proteins, classified by their spectroscopic properties as Cu(II). Type 1, or blue copper centers the copper is coordinated to at least two imidazole nitrogen from His and one sulfur from Cys. In type 2, or non-blue copper sites, the copper is mainly bound to imidazole nitrogen from His. Type 3 copper centers comprise two spin-coupled copper ions, bound to imidazole nitrogen.

Vesicle: Structure within or outside a cell, consisting of liquid or cytoplasm enclosed by a lipid bilayer. Vesicles form naturally during the processes of secretion (exocytosis), uptake (endocytosis), and the transport of materials within the plasma membrane.

Zinc finger: A domain, found in certain DNA-binding proteins, comprising a helix-loop structure in which a zinc ion is coordinated to 2 - 4 cysteine sulfurs, the remaining ligands being His.