

Biochemistry Review (chapters 7 to 10)
March 1, 2010
11:00 am

Chapter 7. Hemoglobin: portrait of a protein in action

Hemoglobin and Myoglobin: compare and contrast.

Heme: structure and functions; Fe^{2+} and Fe^{3+} ; O_2 binding.

Quaternary structure of hemoglobin: the oxygen binding curve; hemoglobin binds oxygen cooperatively; why? molecular mechanism; the concerted model (R and T states); chemical structure of 2,3-BPG; the function of 2,3-BPG; fetal hemoglobin.

H^+ and CO_2 promote the release of O_2 : the Bohr effect: molecular basis; how does blood transport CO_2 .

Mutations in hemoglobin: sickle cell anemia; molecular mechanism.

The accumulation of free α -hemoglobin chains is prevented: α -hemoglobin stabilizing protein (AHSP)

Chapter 8. Enzymes: Basic concepts and kinetics

Enzymes: definition; apoenzyme, cofactors, coenzymes, and holoenzymes; Classification of enzymes (six major types); Gibbs free energy; equilibrium constant and rate constant; active site; the lock-key model and induced-fit model.

Enzyme kinetics (Michaelis-Menten equation): three basic assumptions and derivation of the equation; The meanings of K_M , V_{max} , k_{cat} , & k_{cat}/K_M ; Graphical analysis (Lineweaver-Burt Plot); Simple Inhibition (Competitive, uncompetitive, and noncompetitive or mixed inhibitors); Penicillin (a suicide inhibitor).

Irreversible inhibitors: Group-specific reagents; Affinity labeling; Suicide inhibitors; Transition-state analogs; Catalytic antibodies; how does penicillin function as an antibiotics?

Chapter 9. Catalytic Strategies

A Few Basic Principles: Covalent catalysis; General acid-base catalysis; Metal ion catalysis; Catalysis by approximation.

Proteases (Chymotrypsin): Mechanism of reaction: catalytic triad, Asp-His-Ser; Oxyanion hole; Specificity (S1 pocket); Other major classes of peptide-cleaving enzymes; HIV protease inhibitor.

Carbonic anhydrases: role of Zn^{2+} ; mechanism; Histidine proton shuttle.

Restriction enzymes (EcoRV): role of Mg^{2+} ; mechanism; Distortion of the recognition site (specific vs. non-specific binding); a simple methylation on adenine to block the digestion by EcoRV.

Nucleoside Monophosphate Kinases (NMP Kinases): the P-loop; importance of Mg^{2+} ; chemical structure of ATP; the mechanism: the induced fit.

Chapter 10. Regulatory strategies: enzymes and hemoglobin.

Aspartate transcarbamoylase (ATCase): allosterically inhibited by CTP (the first committed step; chemical structure of CTP); catalytic and regulatory subunits; Locating of the active sites (PALA); conformational change of the enzyme; T and R states; the concerted model: MWC model; explain why it does not follow Michaelis-Menten kinetics.

Isozymes and covalent modifications: definition; kinases vs. phosphatases; advantages of Phosphorylation; flight and fight.

Zymogen: Definition; the digestive enzymes in the stomach and pancreas; chymotrypsinogen to chymotrypsin; trypsin inhibitor;

Blood clotting: blood clotting cascade and amplification effect; Fibrinogen is converted by thrombin into a fibrin clot; Prothrombin is readied for activation by a vitamin K-dependent modification; the clotting process must be precisely regulated: tissue-type plasminogen activator (TPA).